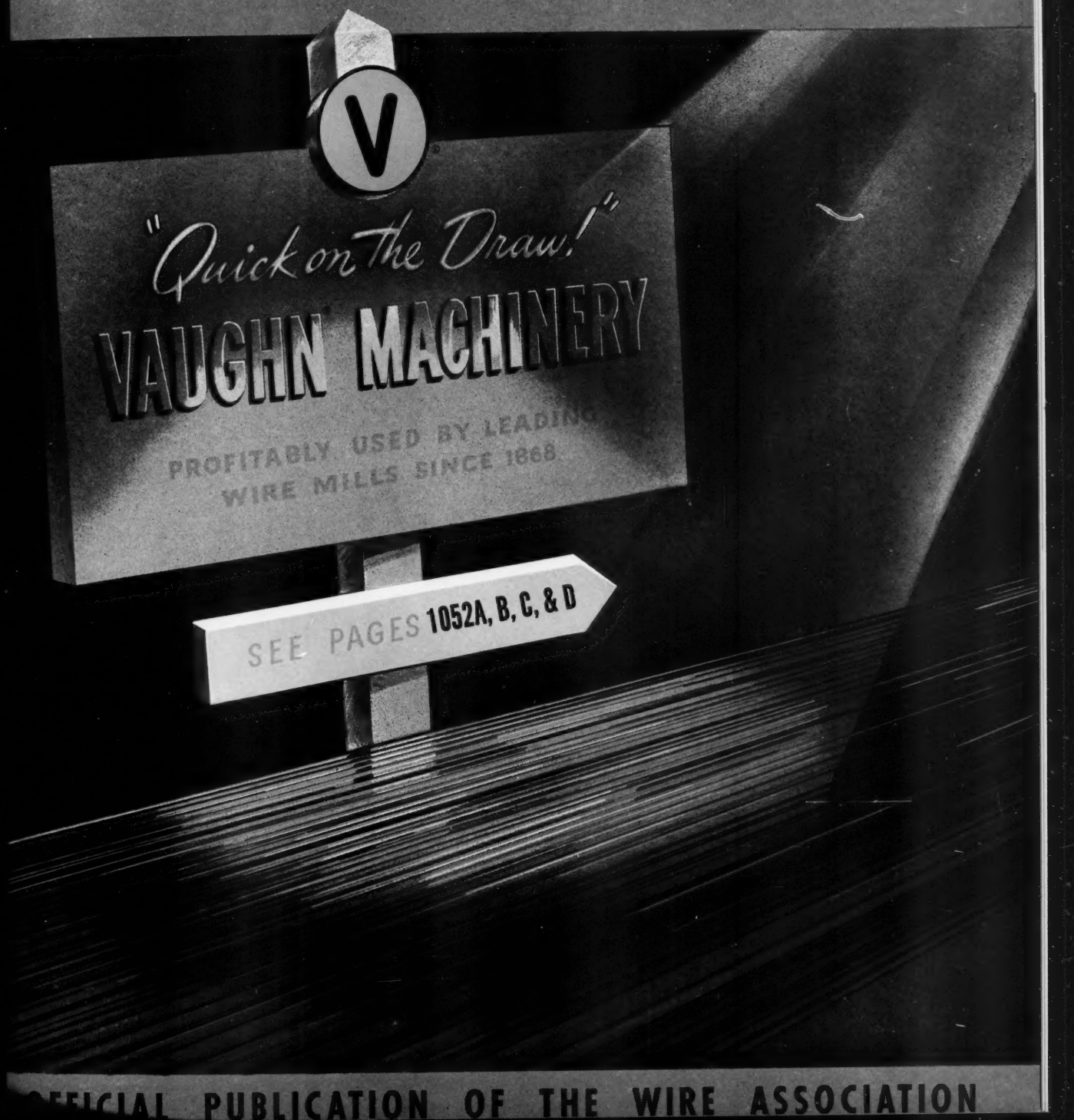
# WIRE AND WIRE PRODUCTS

OCTOBER 1952




OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

# Sjogren WIRE MILL TOOLS

25 1927–1952

## CRAFTSMANSHIP

A keen, watered steel—or Damascus—blade; a finely chased and superbly executed hilt (ornamented in pure silver) demonstrate the craftsmanship of an unknown master swordmaker who six hundred years ago fashioned this Hindu Khanda for some Indian prince,—a product of utility and beauty. For a quarter century Sjogren Wire Mill Tools have demonstrated their craftsmanship; that mating of metal, design and 'know-how' produces a ruggedness and precision of quality which make them do their work well! There is no substitute for craftsmanship.

Photograph of the Khanda (sword) made from an exhibit in the John Woodman Higgins Armory at Worcester, Massachusetts, and shown through their courtesy.

*Used by Wire Men Who Want the Best!*

# SJOGREN TOOL AND MACHINE CO., INC.

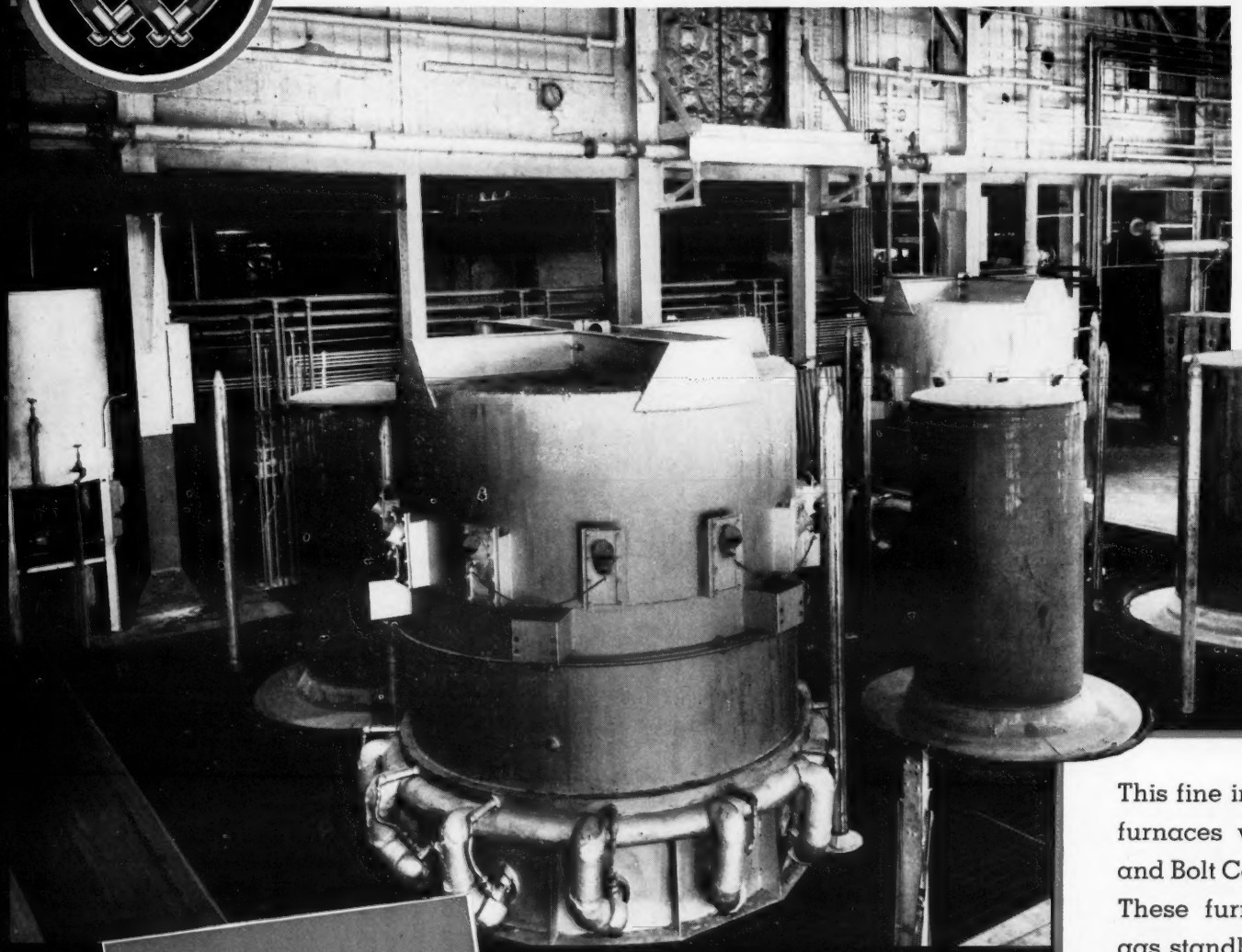
Tools for the Wire Industries

**14 SWORD STREET, AUBURN, MASSACHUSETTS**

*Represented in Canada by* THE LARSON CO., 98 Wellington St., West, Toronto, Ont.

(O)ILSON CYLINDRICAL BELL FURNACE

# WILSON CYLINDRICAL BELL FURNACE



*For*

## ROD AND WIRE COIL SPHEROIDIZING AND ANNEALING

This fine installation of Wilson wire annealing furnaces was made at the Pittsburgh Screw and Bolt Corporation, Pittsburgh, Pennsylvania. These furnaces are equipped with oil-vapor gas standby fuel equipment. Dry nitrogen atmospheres control decarburization.

*Lee Wilson* **ENGINEERING** *Co., Inc.*

20005 WEST LAKE ROAD • CLEVELAND, OHIO
Telephone ED-1-6600

**BELL TYPE FURNACES ★ RADIANT TUBE HEATING ★ ANNEALING PROCESSES**

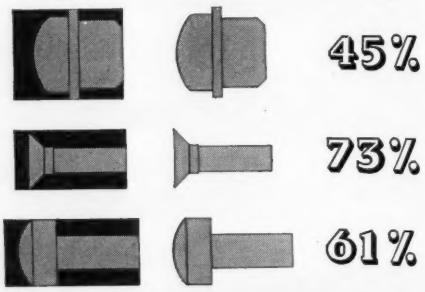
# The right wire for your cold-heading job

When you start with the right steel, cold-heading comes easy. It's Bethlehem's business to supply that steel, in the form of wire that's been custom-made to meet the requirements of your product.

Cold-heading wire has to take punishment—upsetting, extruding, slotting, punching, trimming, pointing. In Bethlehem's wire mills, steel is tested and inspected for internal soundness, uniformity of chemical composition and freedom from injurious surface defects. Accurate size is another detail we watch carefully when we make your cold-heading wire.

We invite you to call on our technical staff for assistance on any problem involving steel wire—for cold-heading or any other use. Phone our nearest sales office or write to us at Bethlehem, Pa.

**Cold-Heading Saves Steel**




BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM WIRE**

BETHLEHEM STEEL

# WIRE INSULATING EXTRUDERS

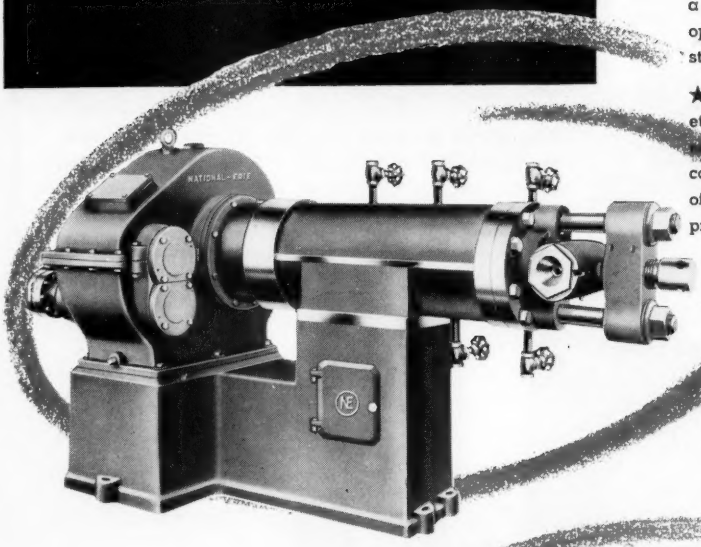
**The National Erie extruder has been developed, after years of experience in design and use, into a machine with outstanding production features:**

★ Drive gearing with precision cut gears and heavy duty thrust bearings of ample capacity have proved the superiority of National Erie design through years of trouble-free operation.

★ Anti-corrosive abrasion resistant cylinder liners and Stellite tipped screws insure long life.

★ The plastics insulating extruder is equipped with a clamp and swing type head which permits quick opening and easy access for cleaning when changing stocks.

★ The feed cylinder on the plastics machine is jacketed for circulation of water and each cylinder extension is drilled for circulation of the heating and cooling media for zone temperature control. A choice of temperature control systems is available to suit the processing requirements of any material.



**FOR PLASTICS**

**FOR RUBBER**

A typical 4½" plastics insulating machine is illustrated above. A typical 3½" rubber insulating machine is illustrated at the right. Both of these machines are available in sizes 1½", 2½", 3½", 4½" and 6". Other sizes available as special designs.

## NATIONAL ERIE STAFF JOINS HALE AND KULLGREN, INC.

The engineering organization of National Erie, including personnel, drawings and records, have transferred to the offices of Hale and Kullgren, Inc., at 613 East Tallmadge Avenue, Akron, Ohio, and are available to you for prompt service on your processing problems. Complete service on parts and information for all existing National Erie equipment is available.

*Complete service on National Erie equipment*

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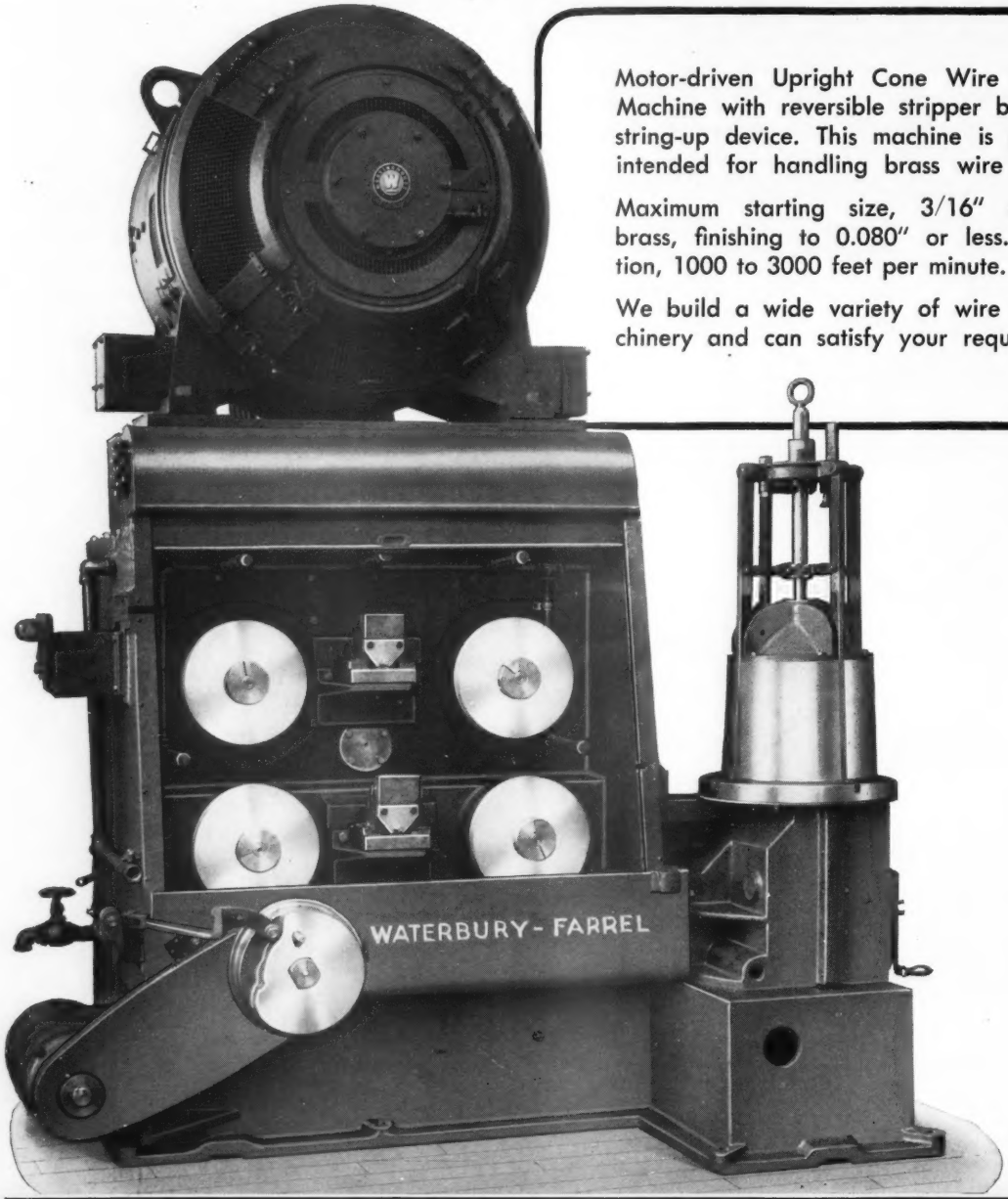
THE AETNA-STANDARD ENGINEERING CO.
PITTSBURGH, PA.

*Plants in Warren, Ohio*
*Ellwood City, Penna.*

# Just one in a wide variety of . . . .

# WIRE DRAWING MACHINES




Motor-driven Upright Cone Wire Drawing Machine with reversible stripper block and string-up device. This machine is primarily intended for handling brass wire in coils.

Maximum starting size, 3/16" annealed brass, finishing to 0.080" or less. Production, 1000 to 3000 feet per minute.

We build a wide variety of wire mill machinery and can satisfy your requirements.

**WATERBURY FARREL FOUNDRY & MACHINE CO. • WATERBURY, CONN.**

**Offices: Chicago, Cleveland and Millburn, N. J.**

*WIRE MILL EQUIPMENT*—Continuous Wire Drawing Machines (Upright Cone and Tandem) • Wire Flattening Mills • Chain Draw Benches • Pointers • Swagers • Bull Blocks • String-up Machines • Spoolers, etc. *COLD PROCFSS BOLT & NUT MACHINERY*—Headers (all types) • Rivet Machinery • Trimmers • Thread Rolling Machines • Slotters • Nut Formers and Tappers, etc. *POWER PRESSES*—Crank, Cam and Toggle; also Rack and Pinion Presses • Eyelet Machines • Multiple Plunger Presses • Horizontal and Hydraulic Presses, etc. *MILL MACHINERY*—Rolling Mills: Strip, Rod, Wire Flattening, (For Ferrous and Non Ferrous Metals) • Also Slitters • Straighteners • Cut-off Saws • Coilers • Winders, etc.

FOUNDED WATERBURY FARREL 1851

# WIRE AND WIRE PRODUCTS

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 27 OCTOBER, 1952 No. 10

Designated as Official Publication By The Wire Association


## Contents


Editor's Desk ..... 1007
Significance of the Elongation Test on Wire
by H. J. Godfrey ..... 1015
ACSR Wire
by F. E. Weise, Jr. ..... 1023
Effect of Certain Impurities on Free Cutting Brass
by G. B. Wood, Jr. ..... 1027
The Control of Wire Drawing Solutions for Copper
by R. C. Williams ..... 1032
Selection and Processing of Chromium-Nickel Stainless Steels for Magnetic Applications
by F. K. Bloom and J. S. White ..... 1036
The Development of Improved Electrical Wiring Materials
by V. McBride ..... 1039
The Drawing of Weaving Wire
by A. S. Knapp ..... 1041
Dry Blending for the Vinyl Extrusion Industry
by M. G. Caine ..... 1043
Weathering Characteristics of Polyvinyl Chloride Type Plastics
by J. G. Hendricks and E. L. White ..... 1053
Creep and Relaxation of High Strength Steel Wire at Room Temperature
by G. T. Spare ..... 1058
Can Quality Control Be Used in the Wire Mill?
by H. H. Passolt ..... 1062
Silicone Rubber: A New Insulating Material for Wire and Cable
by M. G. Noble ..... 1064
Wire Association Convention Program ..... 1065-1070
Government Wire Production Information ..... 1075
Outstanding Personalities of the Wire Industry ..... 1089
A Review of Recent Wire Patents ..... 1096
Index to Advertisers ..... 1143
Where-to-Buy ..... 1145-1148



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**copper and copper alloy**

**WIRE** in all Commercial Tempers and Sizes including Round, Flat, Hexagonal and Special Shapes.

**WIRE FOR SPECIAL PURPOSES**
Copper, Brass, Bronze, Everdur, Nickel Silver and Formbrite* in special grades for the manufacture of rivets, nails, pins, piano hardware, etc. Fine Wire on spools.

**RESISTANCE WIRE**
Nickel Silver.

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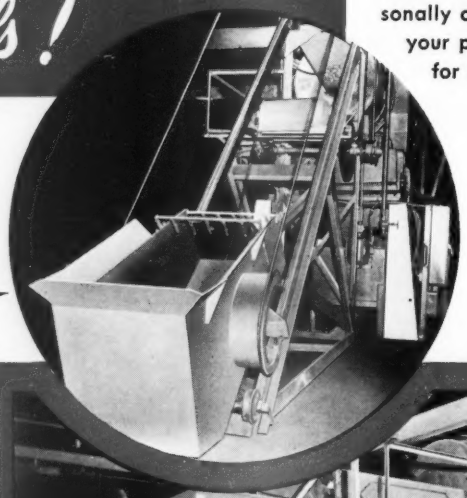
# LET THIS NEW RANSOHOFF *Mechanical Manicurist* CLEAN, POLISH and WEIGH YOUR *Nails!*

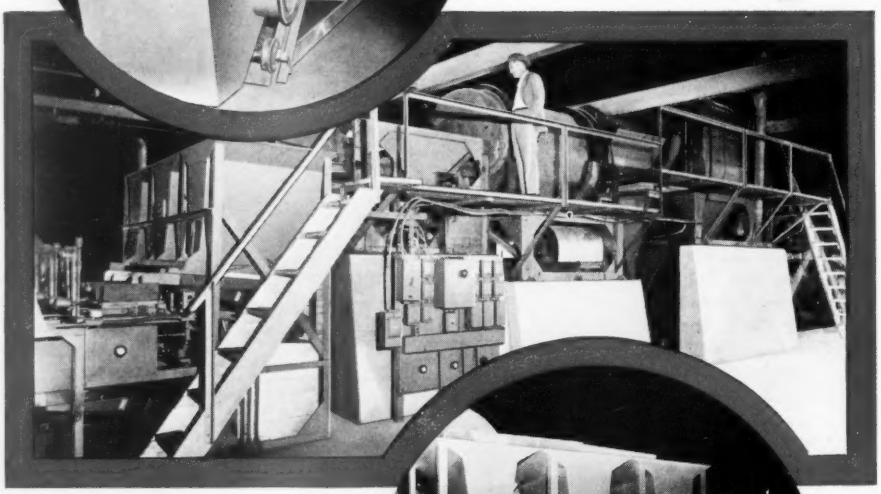
This is your invitation to see and judge, first-hand, the efficiency and economy of Ransohoff nail cleaning equipment.

We invite you and your engineers to visit our Cincinnati Plant and observe for yourselves the speed, capacity and performance of Ransohoff nail cleaning machines. Similar equipment to that illustrated here is at your service. Bring a batch of your nails and personally observe this machine in operation on your product. See why we say it will pay for itself in overall savings.



Nails are loaded in this power loader, so designed that nails will spread rather than bunch. Next, they enter the wet mill which cleans, de-whiskers and de-waters the nails during discharge.

Complete side view of the Ransohoff Nail Cleaning Machine, showing nail cleaning, drying, polishing and weighing equipment. This equipment built with capacity of from 1 to 55 kegs.

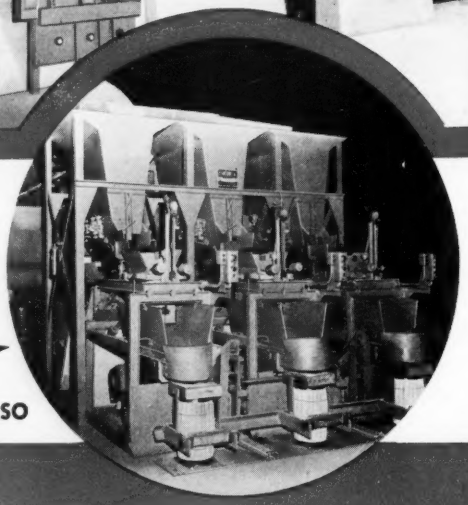


## YOU'LL SEE—

- **Brighter, cleaner nails than by any other process.**
- **One batch delivered every 30 minutes.**
- **Nails loaded and unloaded automatically without manual handling throughout the loading, cleaning, polishing and weighing process, to the point where kegs are ready for heading.**
- **Automatic weighing: Machine weighs 100 lbs. and stops.**

*Equipment illustrated produces 80 kegs of finished nails per hour in Atlantic Steel Co. plant, Atlanta, Ga. See similar equipment tested with your product in Ransohoff's Cincinnati plant.*

After cleaning, nails pass into hot cob meal, where they are dried and polished. Cob meal is automatically separated from the work, and nails fed into weighing hoppers, where they are automatically weighed and fed into kegs.



**LET US DISCUSS YOUR GALVANIZING PROBLEMS WITH YOU ALSO**

# N. RANSOHOFF, inc.

**EQUIPMENT FOR THE SURFACE TREATMENT OF METAL**

**5821 VINE STREET, CINCINNATI 16, OHIO**

# Fastest Process Annealing FOR COILED STEEL WIRE

- ✓ Annealing cycles accomplished in minutes rather than in hours
- ✓ 50% lower equipment cost
- ✓ less floor space
- ✓ no scale, decarburization, or other atmosphere effects

On-the-job production figures prove that no other method compares with an Ajax Electric Salt Bath Furnace in speed, uniformity, cost saving, and general all-around efficiency in process annealing all types of steel wire as well as aluminum, copper alloys, and silver alloys.

Heating cycles are far faster. Absolute uniformity is assured. Thanks to the exclusive Ajax electrodynamic stirring action, the temperature does not vary more than ±5°F. *in any part of the bath.*

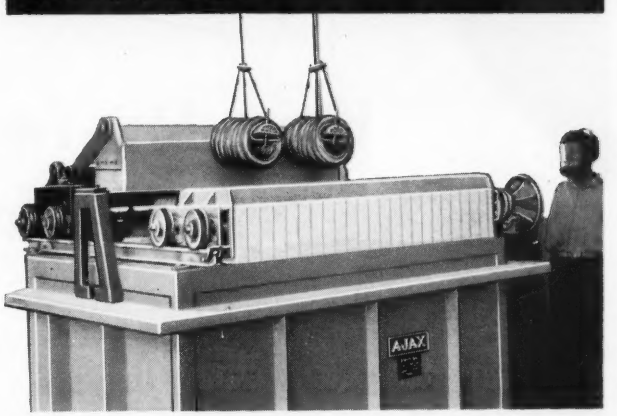
The Ajax Salt Bath eliminates all atmosphere with its accompanying problems of oxidation, pitting, and decarburization. Preservation of metal surface is assured. Equipment cost is much lower —and the Ajax handles more work for a given amount of floor space than any other method. Ajax Reprints 62 and 63 gladly sent on request.

**LOW- AND HIGH-CARBON STEELS**

This typical Ajax installation process anneals 1200 lb. 18-gauge wire an hour in only 58 feet of floor space.

**STAINLESS STEEL**

Annealing fine gauge nickel-chromium wire at 1950°F. Clean wire surface eliminates conventional pickling operations.



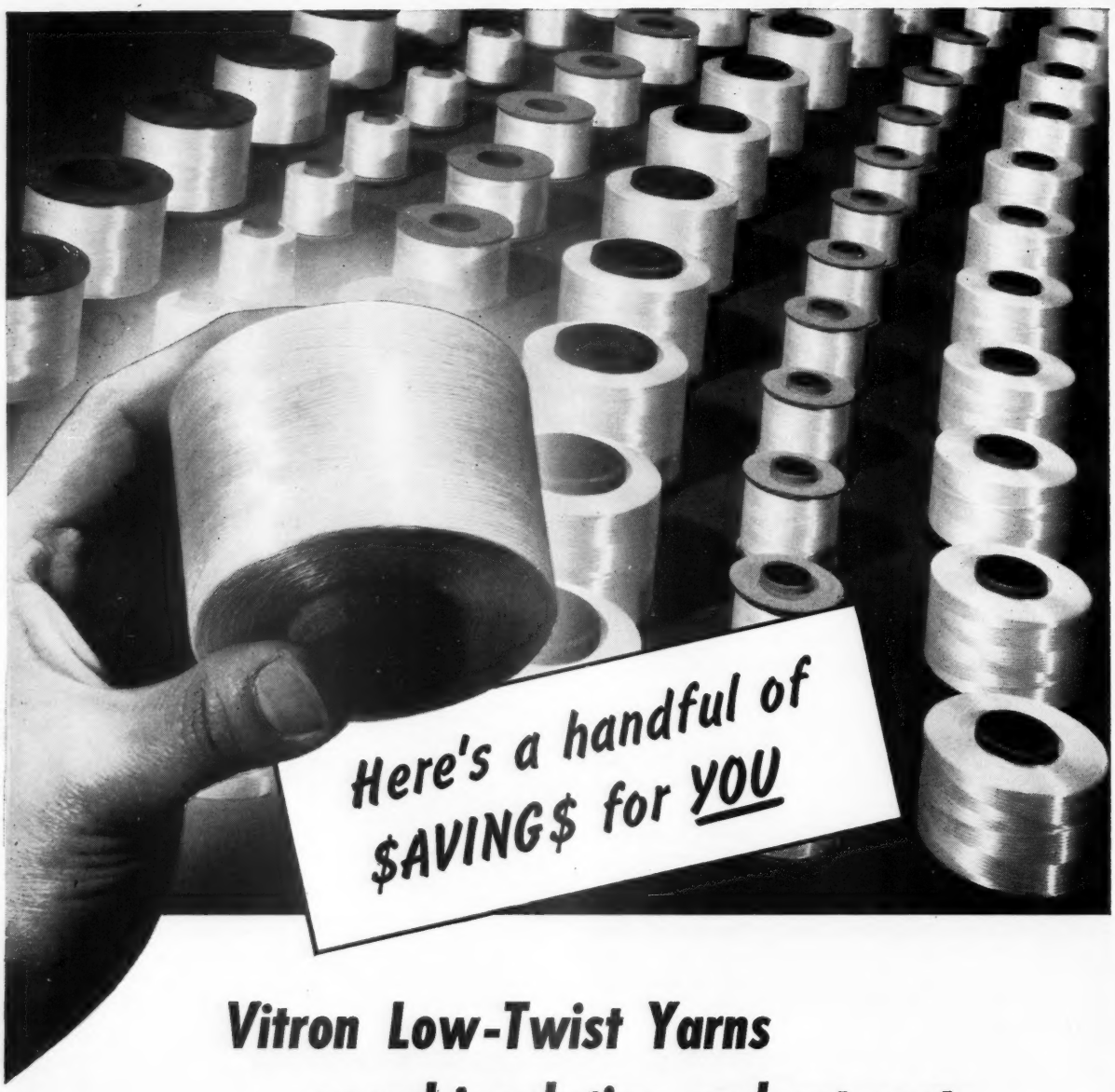

- **TOPS for WIRE PATENTING, too!**
- **IDEAL FOR DESCALING** hot-rolled stainless and alloy steel wire and other shapes employing either the Dupont sodium hydride or the Hooker Electrochemical Virgo bath.

Associate companies: Ajax Electric Furnace Corp. • Ajax Engineering Corp. • Ajax Electrothermic Corp.

# AJAX electric SALT BATH furnaces

OVER 4,000 INSTALLATIONS . . . more than all other salt baths combined

**AJAX ELECTRIC CO., INC., 928 Frankford Ave., PHILADELPHIA 23, PA.**




# Vitron Low-Twist Yarns speed insulating and cut costs

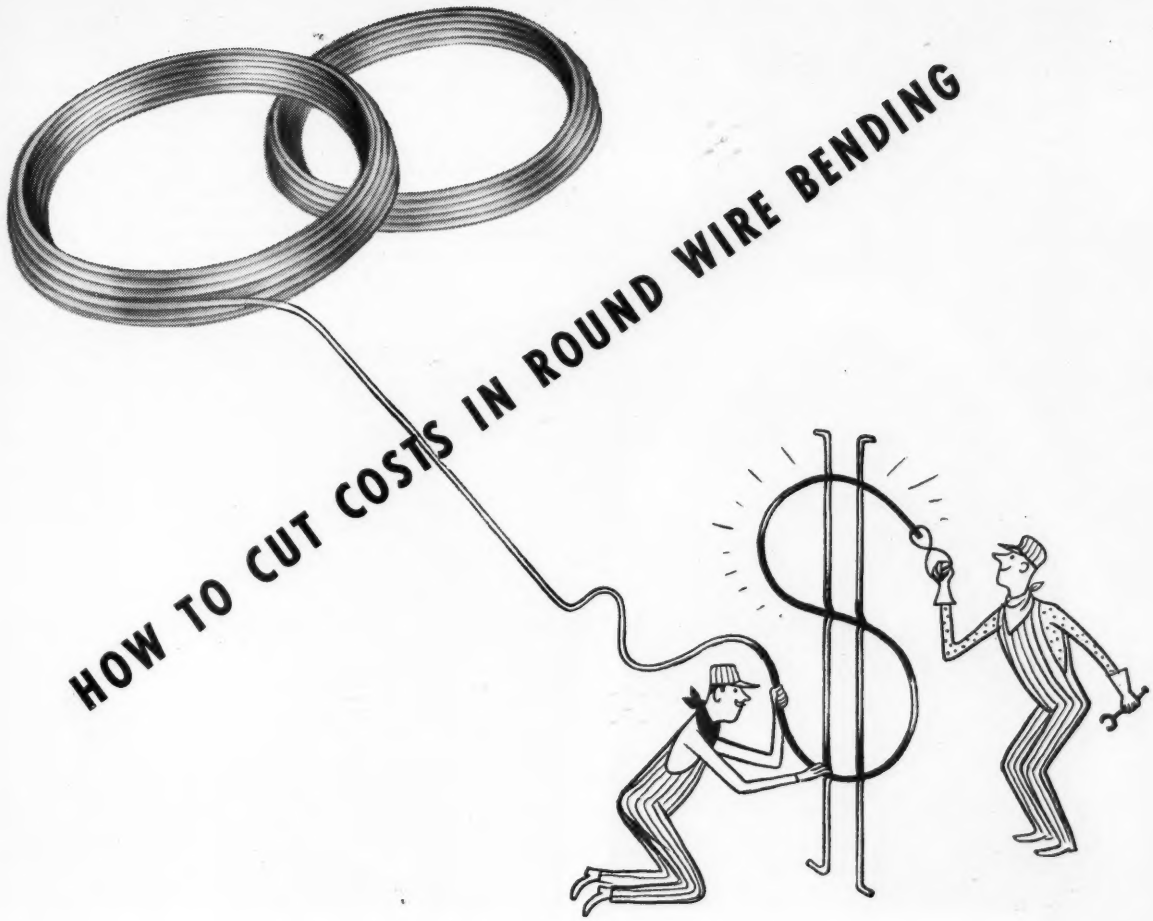
Low-Twist VITRON Yarns increase efficiency in magnet wire production, by permitting build-up control through variations in pull-out and flyer speeds. Each package serves a wide range of needs, and a sound inventory can be maintained with fewer types of packages. These savings, plus the lower cost of low-twist constructions, are cutting over-all costs in many wire processing operations.

Glass Fibers Inc. first offered low-twist in an exclusive yarn size—VITRON 300's. This program proved so successful that wire processors requested the complete range of VITRON yarns—450's, 300's, 225's and 150's—be made available in low-twist constructions.

We would like to tell you how you can save money with these important products. We can show where insulating costs have been cut as much as 20% to 40% over previously used yarns by shifting to low-twist constructions. A letter or call from you today will put our engineers at your service.

**GLASS FIBERS INC.**
1810 Madison Avenue • Toledo, Ohio

Vitron
**ELECTRICAL INSULATING MATERIALS**




**Because** Chase wire is highly "workable" you'll find it superior for round wire bending techniques which permit fabricating of complex shapes *in one continuous operation.*

**Chase brass and copper** wire is extremely ductile and malleable. This makes it particularly desirable for embossing, drawing, forming, shearing, cold-heading and other operations. It is also easily soldered, brazed, and welded.

**Chase wire comes in rich colors** ranging from copper red to golden color for manufacture of gold-plated ware. Painstaking inspection assures you a clean, smooth surface which means lower plating and polishing costs.

Chase BRASS & COPPER

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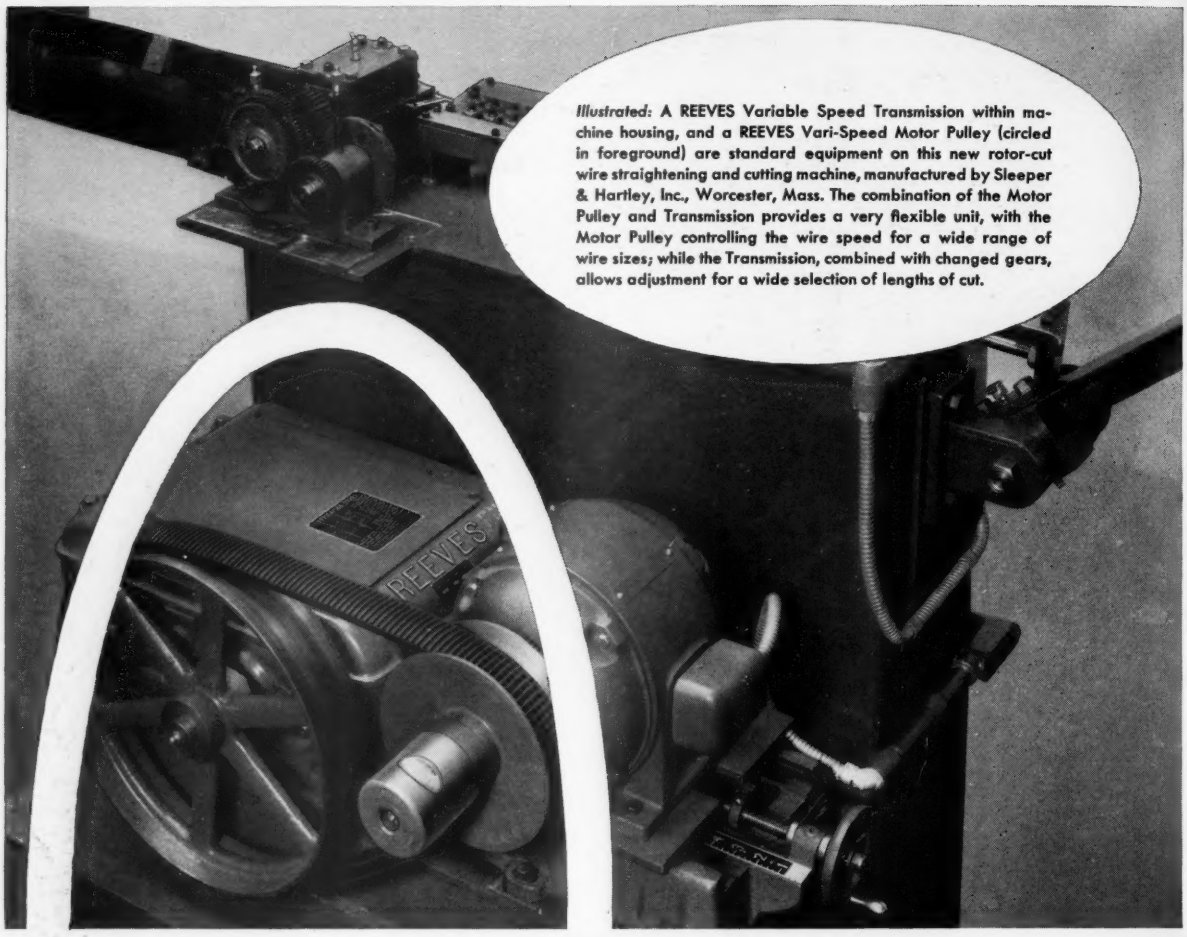
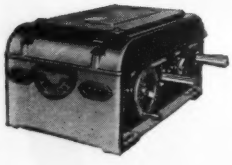
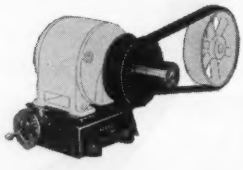



*Illustrated:* A REEVES Variable Speed Transmission within machine housing, and a REEVES Vari-Speed Motor Pulley (circled in foreground) are standard equipment on this new rotor-cut wire straightening and cutting machine, manufactured by Sleeper & Hartley, Inc., Worcester, Mass. The combination of the Motor Pulley and Transmission provides a very flexible unit, with the Motor Pulley controlling the wire speed for a wide range of wire sizes; while the Transmission, combined with changed gears, allows adjustment for a wide selection of lengths of cut.

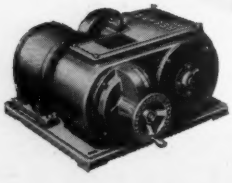
## Choose from the *complete* line of variable speed drives



**VARIABLE SPEED TRANSMISSION:** Provides stepless speed adjustability over a wide range—as high as 16 to 1; sizes to 87 hp. Vertical or horizontal designs—open or enclosed.



**VARI-SPEED MOTOR PULLEY:** Converts any standard, constant-speed motor to a variable speed drive. Speed variations up to 4 to 1. Sizes to 10 hp.



**VARI-SPEED MOTODRIVE®:** A complete variable speed power plant. Combines any standard, constant-speed motor, REEVES speed-changing mechanism and gear reducer in one, compact unit. Sizes to 25 hp; speed ratios as great as 10 to 1.

## Your best bet where machines must work together — REEVES Variable Speed Drives

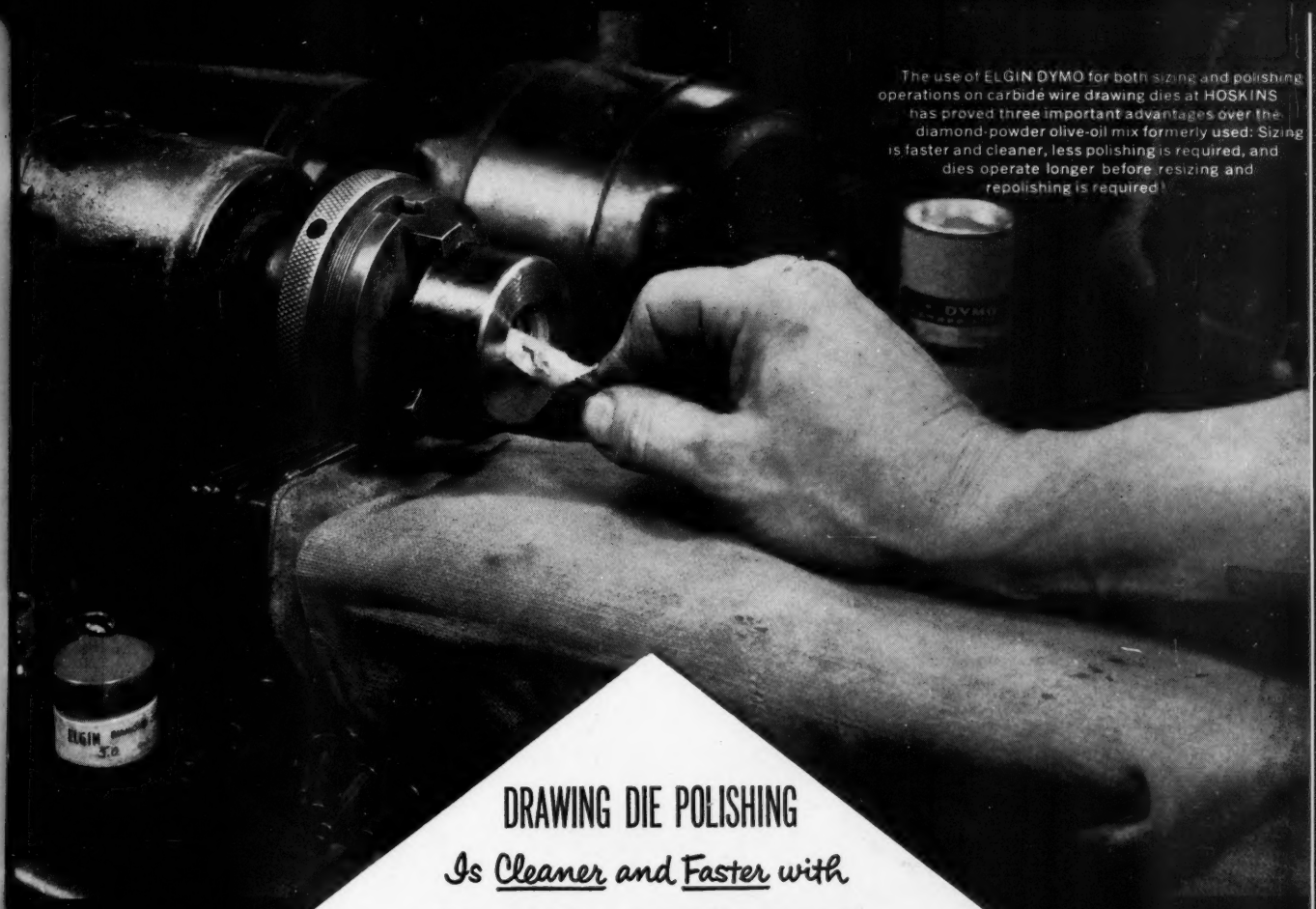
For a perfectly synchronized performance of different parts of one machine or machines operating in series, rely on REEVES Variable Speed Drives. REEVES provides the accurate and infinitely variable speed control that assures a continuous flow of materials or parts from one machine to another, or from one section of the machine to another . . . reduces waste and insures production of uniformly high quality at the maximum rate. The completeness of the REEVES line—with any type of controls desired—enables you to obtain any type of hook-up to meet your own precise variable speed needs. For machines now in service or the new ones you buy, specify REEVES. Send for catalog, No. WP84-G.

**REEVES PULLEY COMPANY • COLUMBUS, INDIANA**

Recognized leader in the specialized field of variable speed control

**REEVES** Variable Speed Drives

for *accurate* speed control



The use of ELGIN DYMO for both sizing and polishing operations on carbide wire drawing dies at HOSKINS has proved three important advantages over the diamond-powder olive-oil mix formerly used: Sizing is faster and cleaner, less polishing is required, and dies operate longer before resizing and repolishing is required.

# DRAWING DIE POLISHING

*Is Cleaner and Faster with*

# ELGIN DIAMOND

**. . . at HOSKINS MANUFACTURING COMPANY**

in Detroit, leading producers of high alloy resistance wire. Elgin's ready-to-use packaging and color identification of the various grades add still further savings in shop time. Elgin Diamond in DYMO will reduce your finishing and polishing costs, too, and give you uniform top quality results. That's why more and more of the country's leading wire mills . . .

*Finish with Diamond ... ELGIN Diamond!*

**DYMO** ...FOR GENERAL POLISHING

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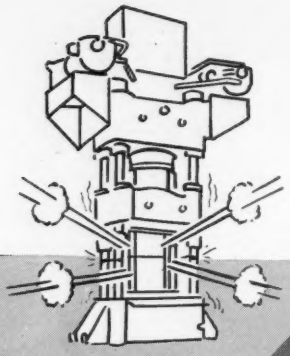
ABRASIVES DIVISION, DEPT. G

## ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS



# Tough draws are easy with Talide Dies

● As a production man, you know of the trouble-free, phenomenal results with Talide Carbide Dies on runs up to a million or more pieces. Long, uninterrupted service life—20 to 50 times greater—makes Talide Dies less expensive than steel dies. Many draws today would be impossible without carbide dies. Pickup, scoring or scratching is eliminated.

A lustrous surface finish results, adding greater sales appeal to your product.

Whether your problem involves a deep draw, tough draw, or a heavy draw—they are all easier with Talide Dies.

You can obtain Talide Dies in sizes from pinpoint to 24" diameter and in many complex shapes.

*SEND FOR DIE CATALOG 50-G*

METAL CARBIDES CORPORATION
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## METAL CARBIDES CORPORATION

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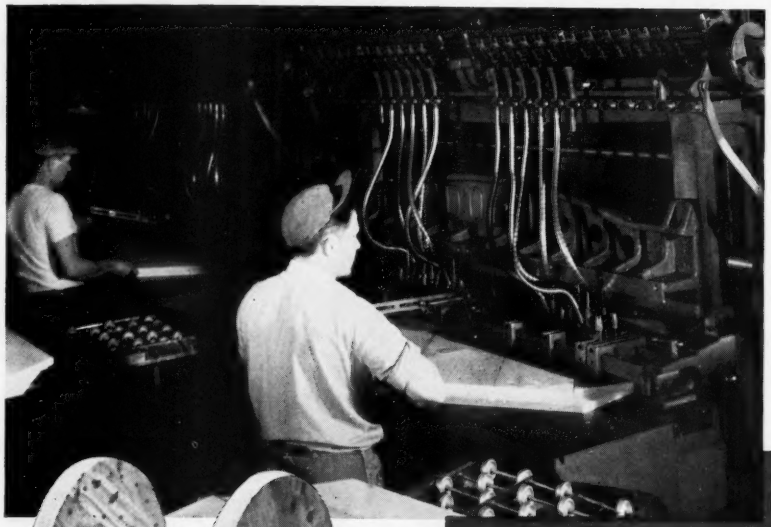
SINTERED CARBIDES • HOT PRESSED CARBIDES
CUTTING TOOLS • DRAWING DIES • WEAR RESISTANT PARTS

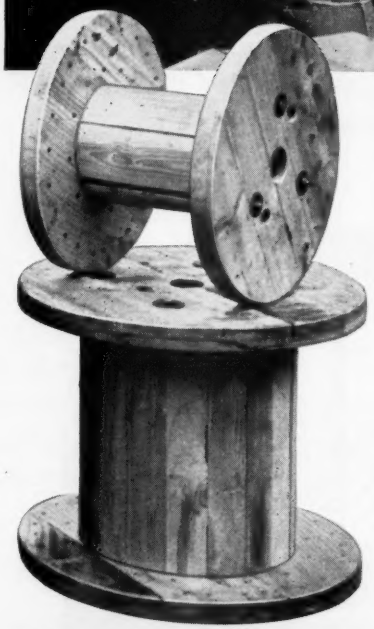
OVER 25 YEARS EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

# EFFICIENT, STREAMLINED PRODUCTION METHODS RESULT IN THE BEST POSSIBLE



## WOOD REELS for CABLE • ROPE • WIRE

12" to 96" in diameter.
Knocked down or assembled.
Returnable or non-returnable.
Reel heads for steel drums.
(Left: Automatic Nailing Machine)



## BRIDGE PLANNING GETS ORDERS FILLED PROMPTLY

These production methods, plus Bridge's unique distribution service — truck and fast rail facilities — provide wood reel users with a combination of finely made reels and a good delivery service. Special equipment both for materials handling and manufacture make for volume production with a minimum loss of production time.

Low in cost, too, because of the exceptionally efficient straight-line production methods.

### PLUS A SPEEDY SHIPPING SERVICE

Bridge delivers by truck to your door within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

**BRIDGE**
MANUFACTURING CO.
HAZARDVILLE, CONN.
Phone Thompsonville, 3375

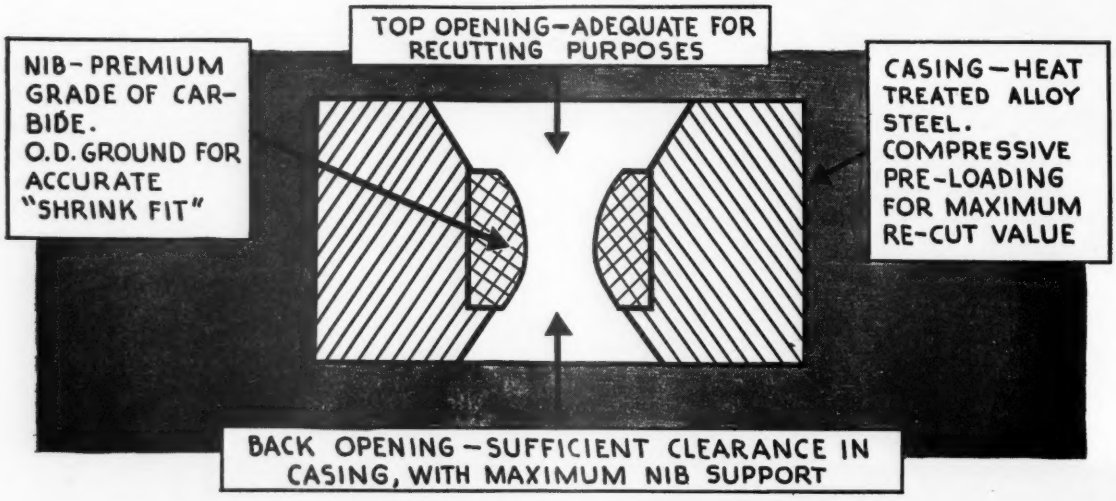
Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.

# YOU WILL DRAW MORE AND BETTER WIRE

## IF YOUR WIRE DRAWING DIES ARE PROPERLY DESIGNED

Special features are designed and built into EASTERN CARBIDE'S DIES that make these dies last longer, produce better wire and give higher poundage per die. Our dies will give you super-performance, save you money and conserve metal.

**These dies can be bought semi-finished at the standard price of rough-drilled dies. They require only light sizing and polishing.**


TOP OPENING—ADEQUATE FOR RECUTTING PURPOSES
NIB—PREMIUM GRADE OF CARBIDE. O.D. GROUND FOR ACCURATE "SHRINK FIT"
CASING—HEAT TREATED ALLOY STEEL. COMPRESSIVE PRE-LOADING FOR MAXIMUM RE-CUT VALUE
BACK OPENING—SUFFICIENT CLEARANCE IN CASING, WITH MAXIMUM NIB SUPPORT

We also supply a full line of superior carbide tooling for the Cold Heading Industry.

## EASTERN CARBIDE CORPORATION

**Telephone: New Rochelle 2-6630**

**55 DRAKE AVE.** **NEW ROCHELLE, N. Y.**

*Complete Carbide Sales and Service*

# "THIS IS IT"!

**"This is IT"! said the Vice President of one of our well-known stainless steel welding rod manufacturers, when we asked him how he liked TIOXICOAT.***

**By "it", he meant that TIOXICOAT is doing a remarkably fine job on stainless steel rods and wire WITHOUT ACID PICKLING, without lime, and without lead coating! Users of Tioxicoat are drawing stainless steel rods as much as four drafts before annealing and, after annealing, from six to ten drafts.**

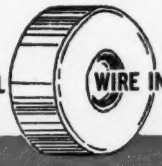
**Think of what this means . . . no loss of metal due to pickling . . . stable alloys, free from acid attack . . . no costly lead to strip off before annealing . . . no acid to buy or to dispose of . . . no inhibitors . . . no fumes . . . and, in most cases, the saving of at least one anneal. Think of the time and handling saved. Translate all this into terms of greater output of finished wire and into dollars and cents, and see what it can mean to *your* mill.**

***For mechanically-descaled patented high carbon rods and wire, too, TIOXICOAT is doing a fine job. You have never seen such a beautiful finish! Such a beautiful color!***

***TIOXICOAT has been tested by one of our leading research organizations, with splendid results.***

*TIOXICOAT

*Pat. Pending

THROUGH THIS DIE PASSES THE MOST BEAUTIFUL  WIRE IN THE WORLD - DRAWN WITH TREMBICKI COATING COMPOUNDS.

THE TREMBICKI COMPANY

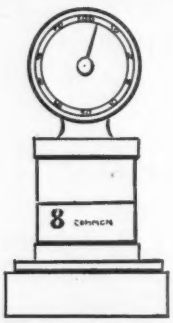
1055 GRANVILLE AVE. CHICAGO 40, ILLINOIS

# It's easier to ship nails in

## INTERNATIONAL'S keg-it

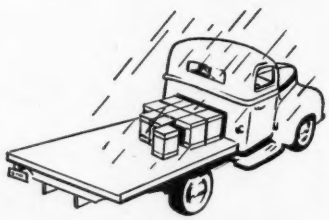
**The sturdy, square shape fills rapidly, palletizes easily and, because of its smaller size, is easier to ship by truck, freight car or barge.**

**We're shipping the *3rd* million of these new low-cost fibre packages to nail manufacturers from our nearby factories. The KEG-IT is more efficient and easier to use in assembly, at the shakers, in your warehouse or on a construction job. If you'll write us, we'll be glad to show you what the KEG-IT can do for you.**



**LESS WEIGHT**
**... weighs 3 to 4 pounds less— cuts freight costs.**

**SMALLER SIZE**
**... up to 30% savings in space.**



**BETTER PROTECTION**
**... stands up in wet weather due to tough wood fibre construction and water-resistant adhesive.**

**International Paper company**
**CONTAINER DIVISION**
220 East 42nd Street, New York 17, N. Y.

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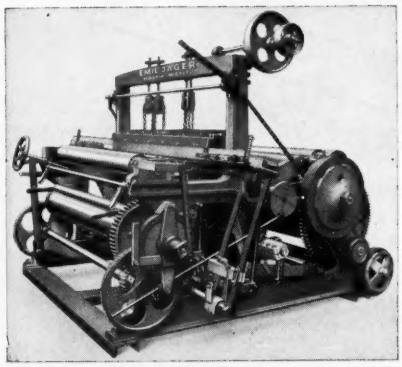
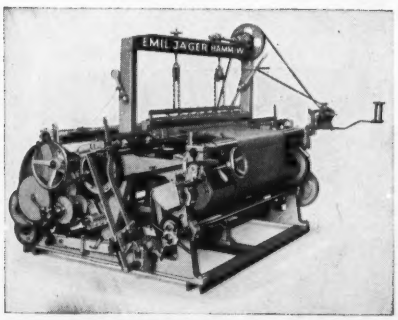
Wooster, Ohio 689 Palmer St.
Philadelphia, Penn. 1126 Lincoln-Liberty Bldg.
Georgetown, So. Carolina

# ORIGINAL "JAEGER" WIRE WEAVING LOOMS and EQUIPMENT

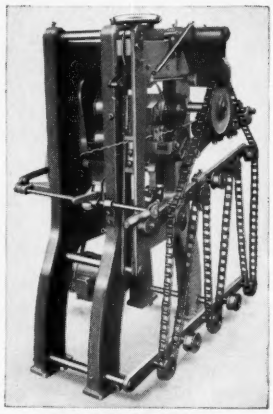


Model DFS. Weaving range 5-120 mesh per inch with wires of .032" and finer.

A complete line of LOOMS for every purpose, from the coarsest to the finest meshes up to No. 450.




Model EFSa. Weaving range of 3/8" to 100 mesh per inch. Especially suited for mosquito screening, Dutch cloth, plaster work netting, etc.



Model KMM Wire Crimper

**FOURDRINIER LOOMS**

**STRETCHING TABLES**

**REEDS and BEAMING DEVICES**

**MULTIPLE SPOOLING MACHINES**

**AUTOMATIC WIRE WEAVING POWER LOOMS**

**AUTOMATIC PIRN OR BOBBIN WINDERS**

**AUTOMATIC POSITIVE MOTION LOOMS**

**WIRE CRIMPING MACHINES FOR WIRES UP TO 5/8" DIAM.**

**Send for complete details on equipment needed**
**Exclusive Representatives in the U. S. A. and Canada**

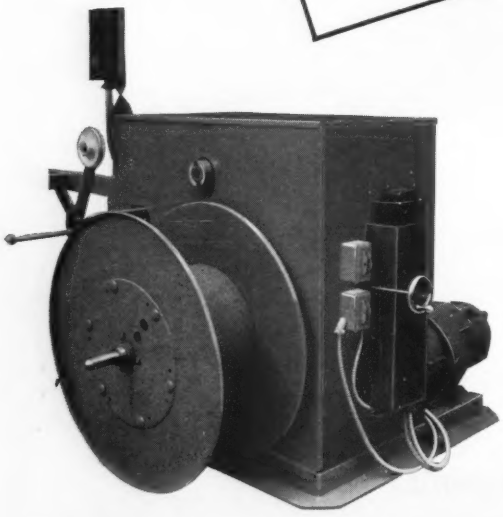
## CEDAR-WEST TOOL COMPANY, Inc., 88-90 West St., NEW YORK 6, N.Y.

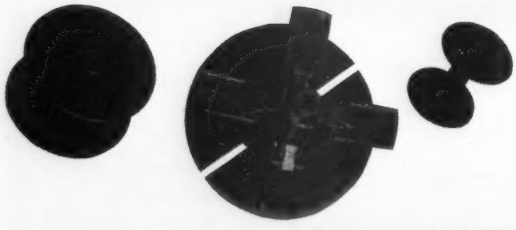
# Now!

## INTRODUCING

## THE COMBINATION MACHINE LONG AWAITED BY THE WIRE INDUSTRY —ELECTRONICALLY CONTROLLED—

**THE**
**DAVIS REELER AND RE-SPOOLER**





**THE NEW DAVIS REELER AND RE-SPOOLER**

**is equipped with a Davis predetermined counter for recording production. Stops automatically at any selected footage. A tachometer can also be furnished to indicate speeds.**

This new combination machine, designed and developed as a result of Davis engineering research, is the last word in efficient and economical production. Of all welded steel construction, the combination is rugged, precision made and vibrationless.

Designed for use with the completely automatic DAVIS SPARK TESTING EQUIPMENT with your tinning or other present equipment. Adapted for use with any type collapsible coiling head up to 30″ diam.

### *EXCLUSIVE DESIGN FEATURES*

1. Top re-spooling shaft is interchangeable to accomodate $\frac{5}{8}$″ up to $1\frac{1}{2}$″ diameter shafts—or to your specifications. Reel diameter 2″ to 18″. **Shafts can be interchanged in a matter of seconds.**
2. Lower or take-up shaft is also interchangeable. Sizes are standard—$1\frac{1}{4}$″ or $1\frac{1}{2}$″ diam.—or as you may specify. Reels up to 30″ diameter accomodated on this shaft.
3. Traverse, with variable speed control for all wire sizes, syncronizes with shaft speeds. Traverse width adjustable up to 16″.
4. Constant wire winding speeds over a 10—1 range. Maximum speed, 1200 FPM, but higher speeds available. Speed changes easily made through accessible controls.
5. New ELECTRONIC CONTROLLER starts machine with low torque factor. Avoids stretching and/or breaking of wire.
6. Electric disc brake of 10 to 25 lbs. will be furnished according to your requirements.
7. Safety cap provided for the idler shaft.
8. Constant footage device supplied if desired.

**You are invited to get the facts on this remarkable machine**

DAVIS EQUIPMENT

## DAVIS ELECTRIC CO. WALLINGFORD, CONN., U.S.A.

**HARNESS TESTERS • PAY-OFFS • TRAVERSES**

**SPARK TESTERS • SPOOLERS • TAKE-UPS • CAPSTANS**

# COMPLETELY REDESIGNED AUTOMATIC DAVIS SPARK TESTING EQUIPMENT

The DAVIS SPARK TESTERS, long the standard of excellence in the electric wire and cable industry, has been further refined in design for increased sensitivity and efficiency.

## THE HIGHLY SENSITIVE DAVIS CV SPARKER

Used for testing wire as it comes from plastic or rubber extruding machines, continuous vulcanizers or twinners. This sparker is noted for its remarkable speed of response, *at any speed* of the wire passing through it. Responds in 1/180th/sec.

A reset magnetic counter counts the faults for re-sparking purposes. Fault locations located accurately in 99% of the cases.

BOTH MACHINES ARE SUPLIED FOR STANDARD VOLTAGE. BEAD CHAIN TYPE ELECTRODES FURNISHED IN DIFFERENT LENGTHS FOR DIFFERENT SPEEDS UP TO 1200 F.P.M. VOLTAGE VARIATIONS OF FROM 1000 TO 15,000 SECURED OVER A STEPLESS RANGE. UP TO 30,000 VOLTS, IF DESIRED.

THE DAVIS ELECTRIC COMPANY PIONEERED IN THE DEVELOPMENT OF SPARK TESTING. ITS TESTERS ARE USED THROUGHOUT THE WORLD WHEREVER ELECTRIC WIRE AND CABLE ARE MADE. THESE TESTERS ARE NOW BETTER THAN EVER.

SEND FOR DETAILS

## THE DAVIS NO. 4 SPARK TESTER

is designed particularly for re-sparking. Uses a bead chain electrode. Combined with the DAVIS PAY-OFF STAND, A DAVIS TAKE-UP and a predetermined counter, it becomes a complete Re-Spooler and Re-Sparker. Will re-spool and test wire at speeds up to 1200 FPM. Automatically shuts off when a dielectric fault is located. Standard models take wire up to 1″ diam. Special electrodes for up to 2″ cable.

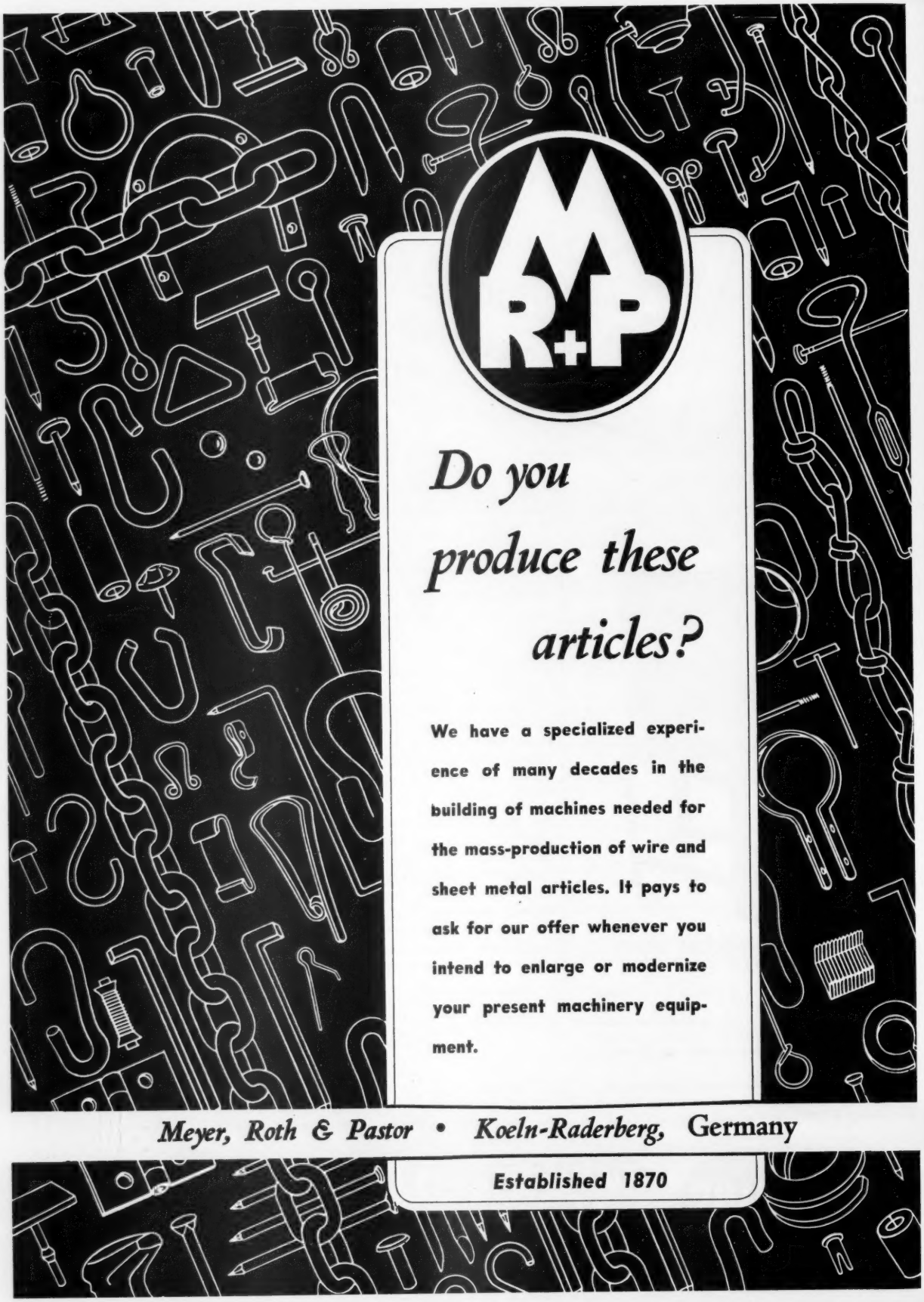
Will locate 99% of the coating faults.

DAVIS EQUIPMENT

**DAVIS ELECTRIC CO.** WALLINGFORD, CONN., U.S.A.

HARNESS TESTERS • PAY-OFFS • TRAVERSES

SPARK TESTERS • SPOOLERS • TAKE-UPS • CAPSTANS


M
R+P
Do you
produce these
articles?
We have a specialized experience of many decades in the building of machines needed for the mass-production of wire and sheet metal articles. It pays to ask for our offer whenever you intend to enlarge or modernize your present machinery equipment.
Meyer, Roth & Pastor • Koeln-Raderberg, Germany
Established 1870

# for strong, tough ACSR cores

## specify Pittsburgh Wire

Made especially for reinforcement of stranded aluminum electrical conductors, Pittsburgh A.C.S.R. Core Wire has the high-tensile strength, the toughness and the heavy uniform galvanized coating to enable you to make the best possible cable.

With this special wire, you get the benefit of the years of experience of one of the largest wire mills in the world. It has an inherent quality that stems from the selected high carbon, open-hearth steel—the uniformity of gage—and the tight adherence of coatings that will work flawlessly in your stranding and closing machines. Available in diameters 0.1878″ to 0.0525″. For information on how to order, write today to Department WWP, Pittsburgh Steel Company, Grant Building, Pittsburgh 30, Pennsylvania.

**Pittsburgh Wire**

*a product of* **Pittsburgh Steel Company**

**Pittsburgh, Pa.**

*Use the Reel that is Made With the*

*Trade Mark Reg. *"PRESSURE PAD" FASTENER** **Patent Applied For.

REEL CONSTRUCTION PATENTED

MAINTENANCE COSTS GREATLY REDUCED

PACKAGE APPEARANCE IMPROVED

PHONE: 2-3043

HOWSAM SPOOL COMPANY

AURORA, ILLINOIS

# A Program for 30 million new Americans

LISTEN to the voices of 30 million new Americans. They are answering the pessimists who say we are threatened with depression because we can't keep our farms and factories busy.

Let these pessimists read the future in the census returns. There is a tremendous upsurge in our population. Last year nearly 4 million babies were born. By 1960 we shall total 170 million people--30 million more than when war ended in 1945. This adds to our domestic market more people than there are in Canada and Australia combined.

Providing for these 30 million new Americans can keep our production machinery going at capacity. They call for new hospitals, schools and churches. Larger families need bigger houses to replace post-war houses that are too small now. More and bigger families need improved home equipment and more new automobiles. In short, to maintain and improve living standards for our children, we must work harder than ever before. To supply the needs of our 1960 population, including adequate national defense, it is estimated that the productivity of the individual worker must increase at least 30%, with additional investment of over 200 billion dollars in capital facilities.

There should be no room in this picture for depression. But we must have economy in government, elimination of waste and extravagance and a reduction of taxes and public debt. If we encourage private incentive, thrift and investment, we can bring about the greatest advance in health, wealth and happiness that America has ever known.

QUALITY · YOUNGSTOWN · SERVICE

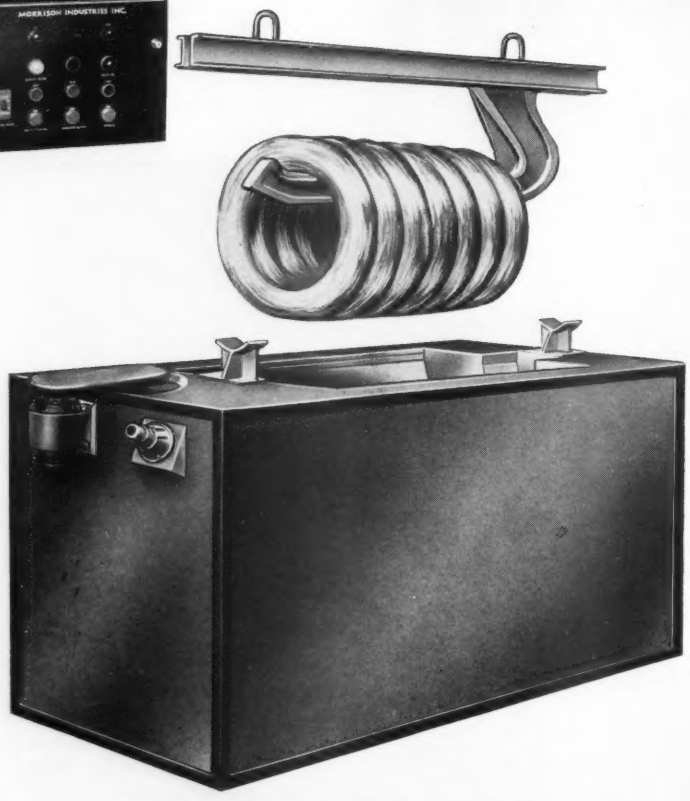
## The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

# NEW-SIMPLIFIED-SMALLER!
# from the HEADQUARTERS for FLASH BAKERS!



**In the nearly 20 years that our engineers have been building rod and wire bakers, they originated the Forced Convection Truck Type — the Flash Baker — and every major improvement in Baker Design.**

**This New Major Improvement in FLASH BAKERS Features —**

**SMALLER SIZE** — Requires a pit no deeper than other tanks in the cleaning line and no larger than the baker proper since all working parts are above floor level.

**FASTER BAKING** — By a new system of air distribution and high velocities the air is directed to the wettest part of the load. This together with a reduction of waste space in the baking chamber makes for the shortest possible baking cycle.

**EASIER MAINTENANCE** — With all working parts above floor level it is easier to service every part of this new FLASH BAKER.

**GAS OR OIL FIRED** — By the use of a combination burner the Baker can be switched to either fuel instantly.

**SHIPPED COMPLETELY ASSEMBLED** — The Baker is shipped complete, ready to lower into the pit. Connecting fuel lines and field wiring completes the installation.

**OTHER M-I EQUIPMENT FOR WIRE AND STRIP MILLS**

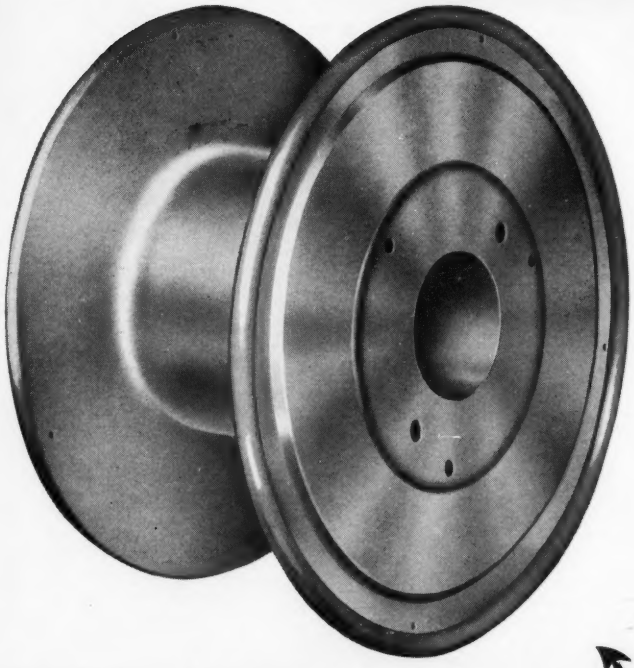
COMPLETE CLEANING LINES
ACID TANKS
SPRAY RINSE TANKS
CLEANING HOUSE HOOKS
PATENTING FURNACES
GALVANIZING FURNACES
COMPLETE PROCESSING LINES
PAINTING SYSTEMS
SPECIAL HANDLING EQUIPMENT

***Write for complete information on FLASH BAKERS or any of this Equipment***

MORRISON INDUSTRIES

**MORRISON INDUSTRIES, INCORPORATED**
17100 MILES AVENUE • CLEVELAND 28, OHIO

# MOSSBERG PRESSED STEEL CORP.



designed

**NO-CREV** SPOOLS

and REELS with

patented **DURA-CURL** rims

providing the ultimate
in strength and durability

P
L
U
S

precision and balance for
high-speed operation.

GREETINGS 1952

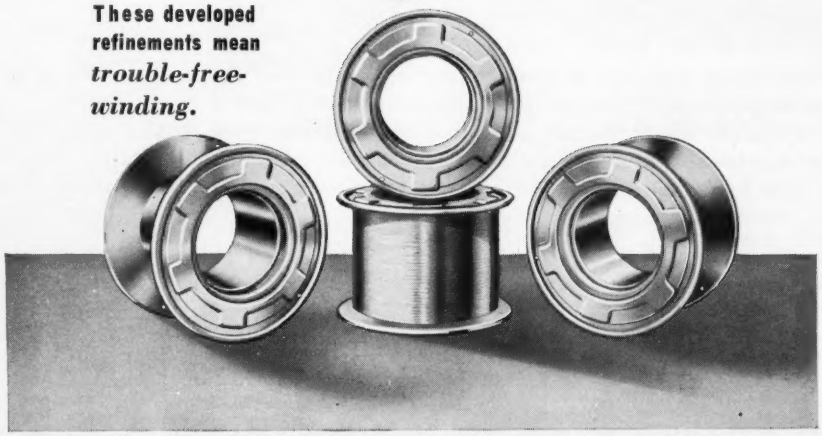
*FROM THE LARGEST HEAVY DUTY*

## BREAK-DOWN-REELS

*TO THE FINEST WIRE—*

## NO-CREV *DESIGN* SPOOLS

These developed
refinements mean
*trouble-free-winding.*

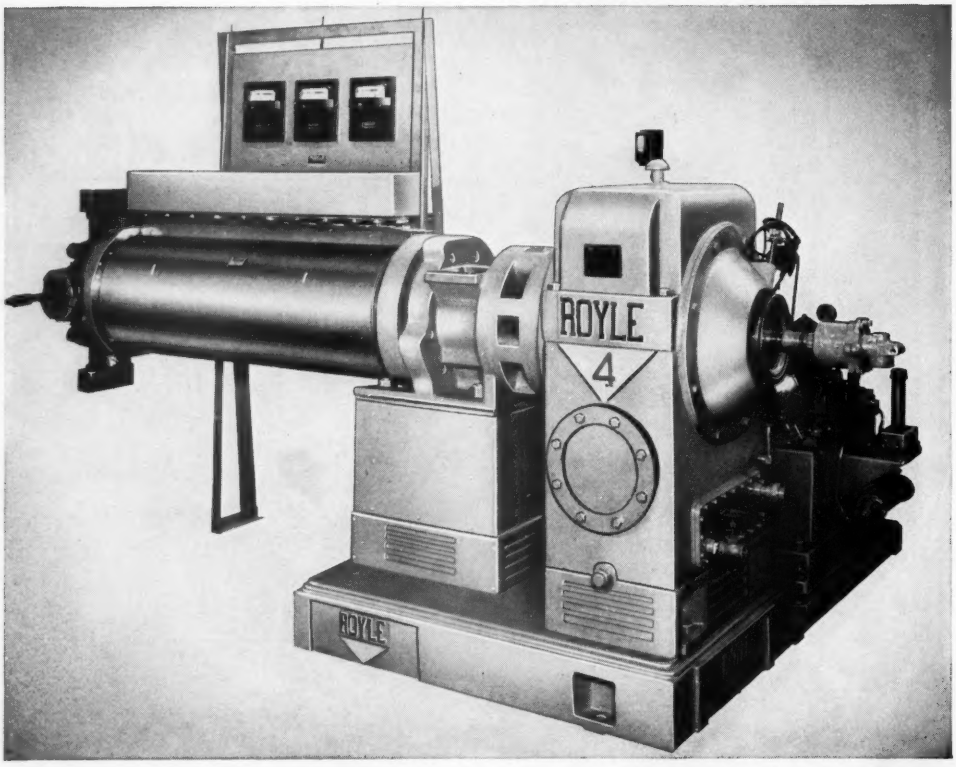


# MOSSBERG PRESSED STEEL CORP.

18 WEST STREET — ATTLEBORO, MASSACHUSETTS, U.S.A. — Telephone Attleboro 1-0847 & 1-0848

James Day (Machinery), Ltd., 28 Maddox Street, London, W. I. England — #105

# ROYLE *SPIROD EXTRUDERS*




Built by America's oldest builders of extruding machines Royle Spirod extruders are the result of more than seventy years experience in the design of extruding machines. Time tested and proven features are built into Royle Spirod extruders to assure maximum productivity at minimum operating cost. These features include: Heavy steel members without flanges . . . Spirally installed rod type heating elements to provide faster, steadier, more evenly distributed heat . . . Complete insulation of cylinder and head to reduce heat loss with substantial power savings . . . Separate heating zones controlled by proportioning instruments.

**CHECK THESE FEATURES** that assure profitable and trouble-free production of such items as plastic insulated wire, flexible and rigid pipe, plastic sheeting, plastic clothes line, to mention a few of the products that are produced daily with Royle Spirod extruders.

**JOHN ROYLE & SONS**

ROYLE PATERSON N. J. 1880

*PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN*

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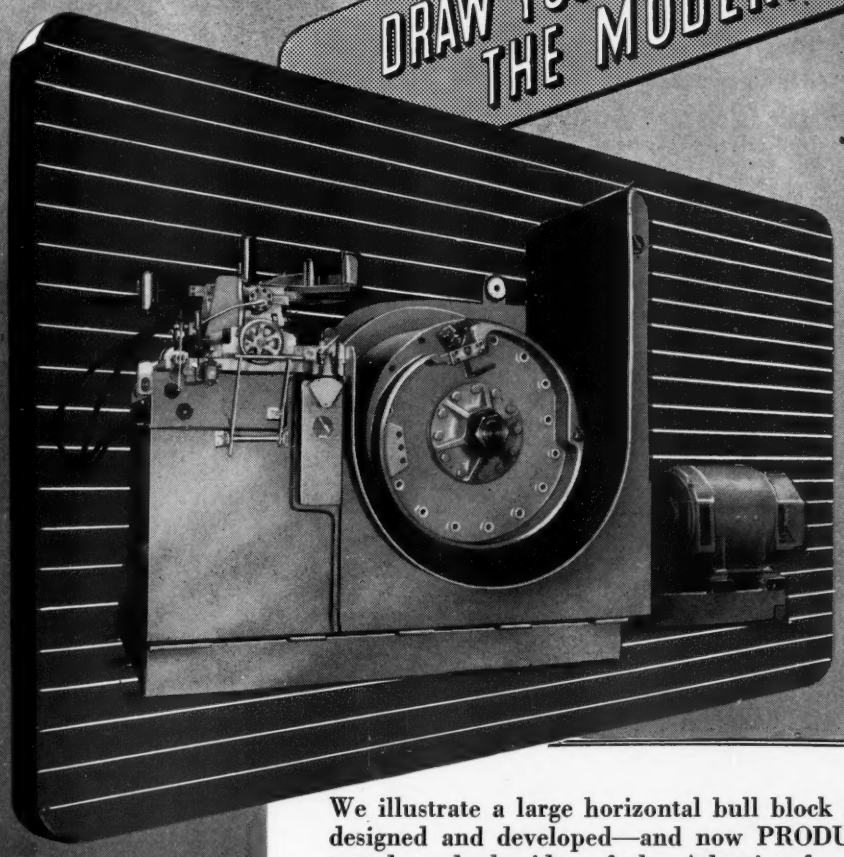
LOgan 3261

# DRAW YOUR COPPER TUBES THE MODERN WAY



We illustrate a large horizontal bull block specially designed and developed—and now PRODUCTION-tested on both sides of the Atlantic—for drawing non-ferrous tubes.

Every possible refinement to aid HIGH, CONSISTENT PRODUCTION is incorporated.

The machine is the type H.66.T with a 54 inch diameter block. It draws tubes from about two inches o/d max., using floating plugs. It has a 75 H.P. motor and provides drawing speeds between 100 and 900 ft. per minute. The tube swift is incorporated and the machine is a PRODUCTION UNIT as soon as it is installed.

**MARSHALL RICHARDS MACHINE CO**

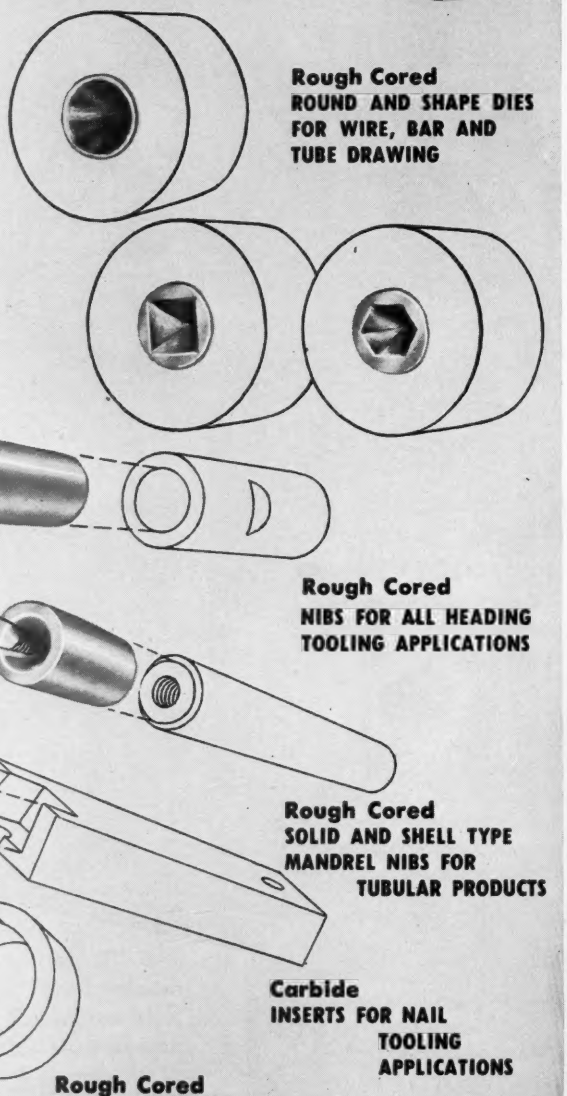
1100 South Broad St., Trenton 10, New Jersey
Telephone: Trenton 6-9478 Telegram: MARICH, Trenton

# Specify Firthaloy

FIRTHALOY Sintered Carbide is the standard of quality for drawing and forming operations. It assures maximum production, uniform size, excellent finish and economical operation. To do work better, faster, and cheaper . . . specify FIRTHALOY Sintered Carbide when ordering from your local tool and die maker.

Firth Sterling supplies standard wire, tube and bar dies in a rough cored condition in sizes up to R7. Dies R7 and larger are available both rough cored and rough drilled. In addition, FIRTHALOY Sintered Carbide is furnished in a wide variety of shapes and sizes . . . . another reason why leading tool and die makers have adopted Firth Sterling as a preferred source.

When you specify FIRTHALOY, you are assured of close co-operation between your tool and die maker and experienced Firth Sterling Service Engineers . . . "teamwork" that adds up to maximum performance and increased production.



**Rough Cored**
ROUND AND SHAPE DIES FOR WIRE, BAR AND TUBE DRAWING

**Rough Cored**
NIBS FOR ALL HEADING TOOLING APPLICATIONS

**Rough Cored**
SOLID AND SHELL TYPE MANDREL NIBS FOR TUBULAR PRODUCTS

**Carbide**
INSERTS FOR NAIL TOOLING APPLICATIONS

**Rough Cored**
NIBS FOR EXTRUDED AND DEEP-DRAWN PRODUCTS

**Carbide**
FOR SPRING FORMING TOOLS AND WEAR-RESISTANT PARTS

Write for the NEW REDUCED DIE PRICE BULLETIN

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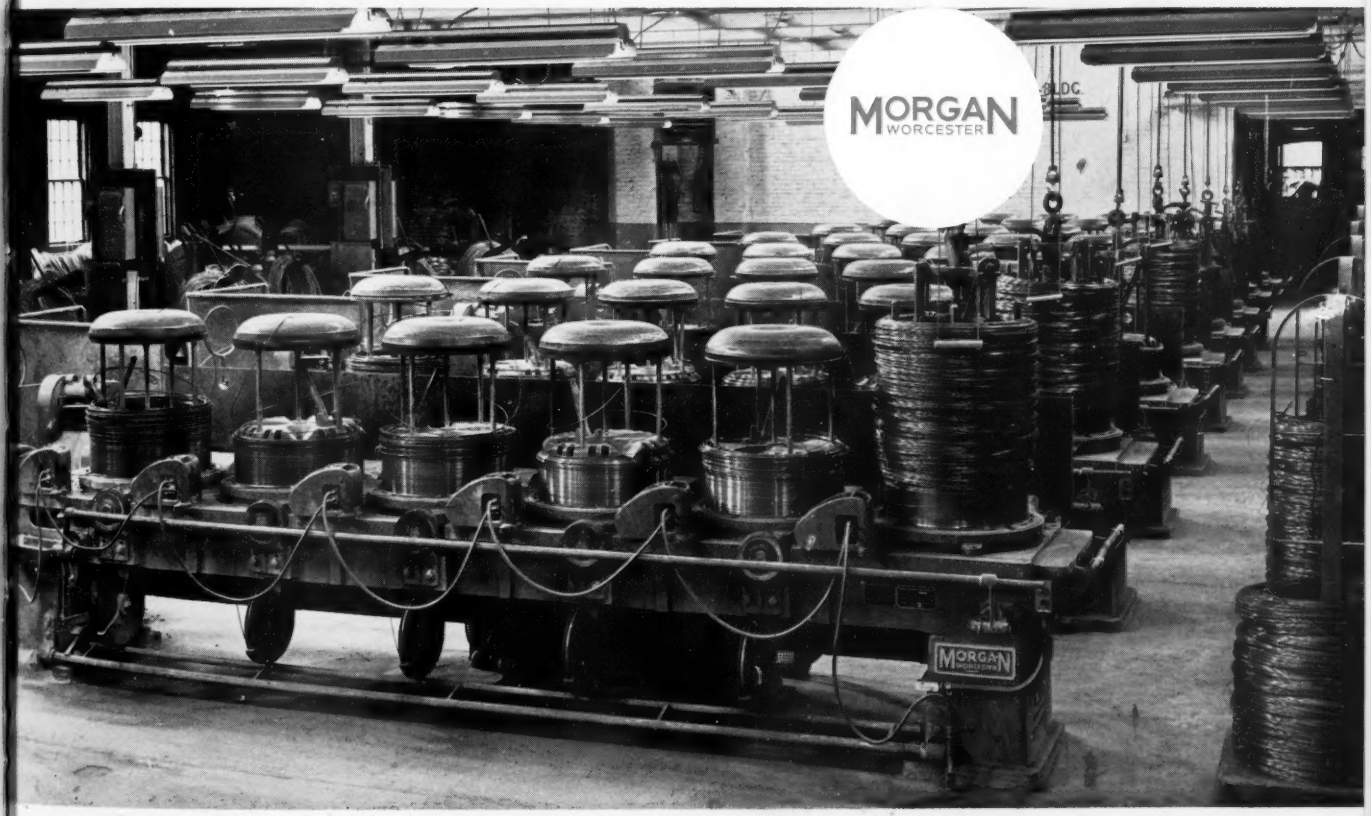
3113 FORBES STREET · PITTSBURGH 30, PENNA.
Offices* and Warehouses:
NEW YORK* • PITTSBURGH* • DAYTON* • HARTFORD • LOS ANGELES
CHICAGO • DETROIT • CLEVELAND • PHILADELPHIA • BIRMINGHAM*

R-263

# Outstanding Results

Recently we announced the results of a series of scientific tests on the temperatures of wire while being drawn. The tests showed the results of reducing wire temperatures by air cooling to be outstanding.

Recent installations of new Morgan-Connors are confirming—in actual mill production—the results shown by our tests.

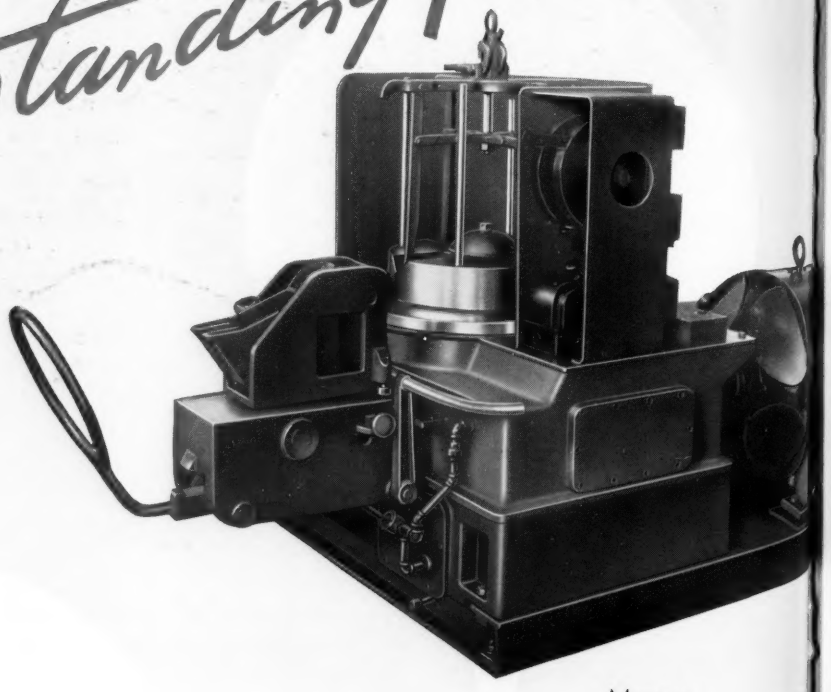



# MORGAN-CONNOR

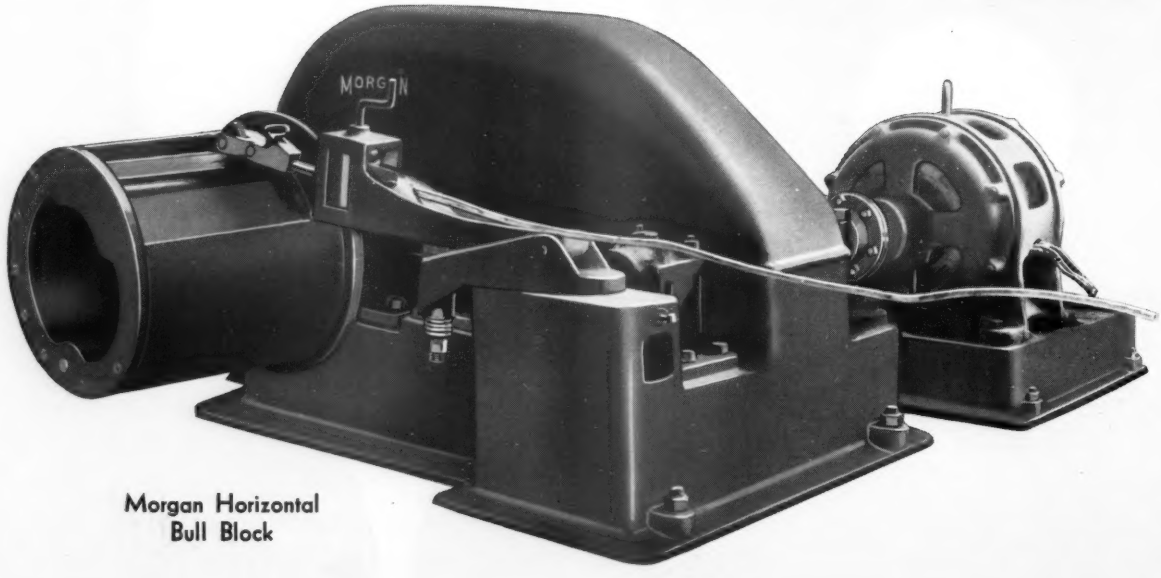
## WIRE MACHINES

WM 67

# These too, are giving *Outstanding Results*



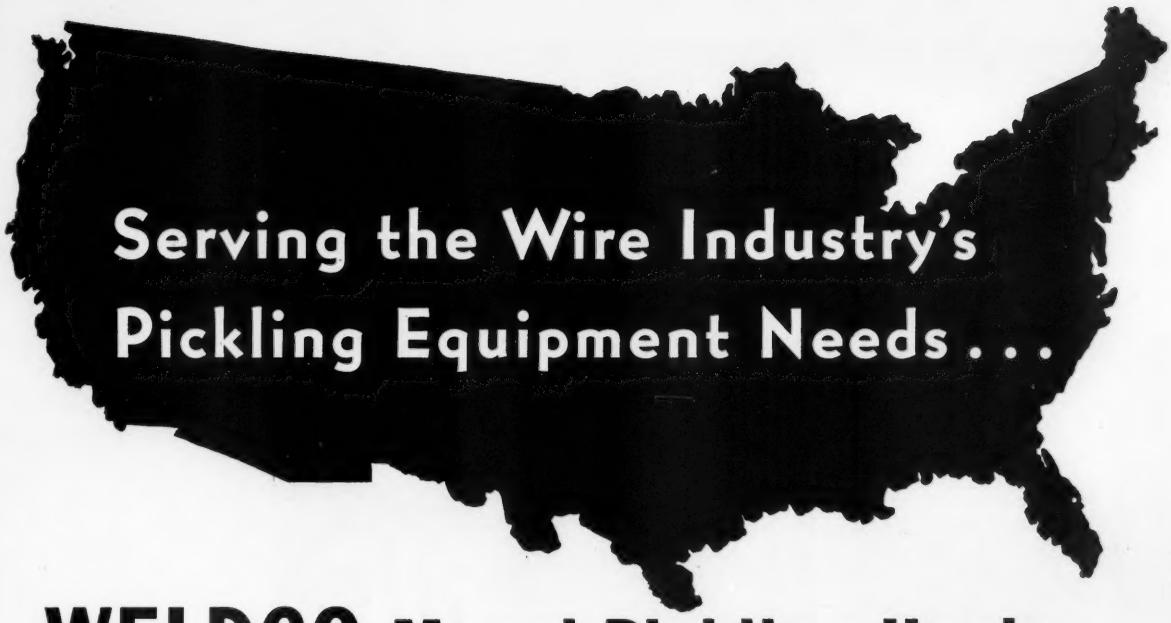
Morgan
Wire Block




Morgan Horizontal
Bull Block

## MORGAN CONSTRUCTION CO.

WORCESTER, MASSACHUSETTS




# WELDCO Monel Pickling Hooks

## Are Used In These Mills:

American Steel & Wire Company - - - - Joliet, Ill.
Bethlehem Steel Corporation - - Sparrows Point, Md.
Bethlehem Steel Corporation - - - Williamsport, Pa.
Detroit Steel Corporation - - - - - Portsmouth, Ohio
Electric Auto-Lite Company - - - - Port Huron, Mich.
Indiana Steel & Wire Company - - - - Muncie, Ind.
Jones & Laughlin Steel Corporation - Aliquippa, Pa.
Keystone Steel & Wire Company - - - - - Peoria, Ill.
Lamson & Sessions Company - - - Cleveland, Ohio
Mid-States Steel & Wire Company - Crawfordsville, Ind.
National Screw & Manufacturing Co. - Cleveland, Ohio
Pittsburgh Steel Company - - - - - - Monessen, Pa.
Reed & Prince Company - - - - - Worcester, Mass.
John A. Roebling & Sons Company - - Roebling, N. J.
Russell, Burdsall & Ward
Bolt & Nut Company - - - - - - - Rock Falls, Ill.
Timken Roller Bearing Company - Gambrinus, Ohio
Washburn Wire Company - - - - - New York, N. Y.
Wickwire Spencer Steel Division - - - Buffalo, N. Y.

**OTHER WELDCO PICKLING EQUIPMENT**

Mechanical Picklers, Crates, Baskets, Racks, Chain, Steam Jets, and Accessories

WELDCO

**THE YOUNGSTOWN WELDING & ENGINEERING COMPANY**
3724 OAKWOOD AVENUE · · YOUNGSTOWN 9, OHIO

WHAT DO YOU NEED?
BIG
ONES
OR
LITTLE
ONES
STANDARD SIZES
Flange | Traverse | Barrel | Arber
2½" | 3" 3¼" | 1¾" | .628"-.633"
3" | 3" 3¼" 3½" | 1¾" or 2" | .625"-.633"
4¼" | 3" 3¼" 3½" | 3¼" | .635"
4½" | 3" 3¼" 3½" | 2½" | .635"
4½" | 6" | 2½" | .635"
5" | 2¾" 3" | 3.880" | .531"
6" | 3" 3¼" 3½" | 3½" | .635"
6" | 3" 3¼" 3½" | 3½" | 3"
6" | 6" | 3" or 3½" | .635"
6" | 6" | 3½" | 3"
6½" | 3" 3¼" 3½" | 3½" | .635"
6½" | 3" 3¼" 3½" | 3½" | 3"
6½" | 6" | 3½" | .635"
6½" | 6" | 3½" | 3"
7" | 3" 3¼" 3½" | 3½" | .750"
7" | 6" | 3½" | .750"
8" | 3½" 6" 6¼" | 4" | 3" or 3 11/16"
8¼" | 3½" to 7½" | 4" | 3.630"
10" | 6" | 5" | Optional
12" | 6" | 6" | Optional
Light weight, drawn Aluminum Alloy
Here they are! A complete line of
ACROPAK SPOOLS... any size for any need
Our job is to help wire manufacturers reduce spooling costs and we've built up a record with these strong, lightweight, drawn Aluminum alloy spools. A complete line—any size you specify—with special emphasis now on big sizes to meet the trend towards larger packaging for economy. ACROPAK spools have reduced operating and shipping costs for others—why not for you, too?
See us at the Convention, Nov. 13, Carter Hotel, Cleveland.
ACROMETAL PRODUCTS INC.
Division U. S. Bobbin and Shuttle Co., 616 Fifth Street N., Minneapolis 1, Minn.

AMERICAN CHEMICAL PAINT COMPANY

AMBLER CHEMICALS ACP PROCESSES PENNA.

# Technical Service Data Sheet

# Subject: IMPROVED DRAWING AND COLD FORMING WITH GRANODRAW

## INTRODUCTION:

When steel is phosphate coated with "Granodraw" prior to working it, drawing, extrusion, and other cold forming operations are greatly improved. In fact, the protective phosphate coating makes the cold extrusion of steel possible.

Getting cold steel to flow depends on the unique properties of this coating. Its non-metallic phosphate crystals are physically and chemically adapted to acquire a strongly adsorbed lubricant. The combination of adherent phosphate coating and adsorbed lubricating film possesses a low coefficient of friction while maintaining its integrity under extremely high deforming pressures.

## "GRANODRAW" DATA

"Granodraw" zinc phosphate coating chemical is applied to pickled surfaces in an immersion or spray process. When used with a suitable lubricant, the coating reduces friction under conditions of low, medium, or high deforming forces encountered in such typical operations as: cold extrusion of steel; cold shaping; deep drawing (tubs, cartridge cases, shells, etc.); stamping; drawing of wire and tubing; ironing; necking; nosing; and upsetting.

## TYPICAL APPLICATIONS

*WIRE.* "Granodraw"-coated fine wire to be wet drawn, is given an 85% to 95% reduction in cross-sectional area at 15% to 25% greater drawing speed. In addition, the appearance and profile of the drawn wire show considerable improvement over uncoated wire drawn with conventional lubricants. One interesting advantage in the use of the phosphate coating is the corrosion resistance imparted to the drawn wire by residual coating adhering to the steel after as many as 13 holes. Loss of such wire because of corrosion during storage has been practically eliminated.

*TUBING.* A tube mill is accomplishing a 40% reduction and a mirror-like inside surface with the aid of "Granodraw" coatings. The speed of this draw is over 100 feet per minute and the die life is considerably longer than when no phosphate coating is used.

*PLATED WORK.* Articles to be plated after forming may now be polished in the flat, formed on the presses, and sent to the plating line with no further polishing. The application of a "Granodraw" phosphate coating and lubricant protects the polished surface during press operations, preventing scratches and gall marks from appearing. Since contour polishing and hand buffing are very expensive, their elimination by the use of "Granodraw" provides considerable savings.

The drawing of wire and many other cold forming operations — including the cold extrusion of steel — are greatly facilitated by the application of a "Granodraw" phosphate coating and a suitable lubricant prior to working.

## TYPICAL APPLICATIONS (Cont'd)

*CARTRIDGE CASES.* The phosphated, lubricated cup for a large cartridge case is given an 80% reduction in four passes with no intermediate anneals or surface treatments. Finish is excellent and the total life extended considerably over components formed without the use of the phosphate coating. In another case, a cup for a shell is phosphated and lubricated and given a 67% reduction with one pass through two dies.

## ADVANTAGES OF PHOSPHATE COATING WITH "GRANODRAW" PRIOR TO COLD FORMING STEEL

The following are among the advantages indicated for phosphate coating with "Granodraw" prior to cold forming steel:

*Drawing of wire, bars, tubing, etc.*—Improved lubrication; improved surface; less scratching; reduced pull; greater percent reduction per pass; reduced die wear; longer die life; lower die maintenance and cost; reduction in corrosion.

*Drawing of stampings, shells, shell cases, etc.*—Improved lubrication; reduced breakage; reduction in scrap; deeper draws; less scratching; elimination of some annealing; less wear on dies.

*Cold Extrusion*—Improved lubrication; increased strength of parts; improved surface; reduction in load on press; greater dimensional accuracy; more uniform wall thickness; longer extrusions; elimination of some annealing; less corrosion.

CHEMICALS ACP PROCESSES

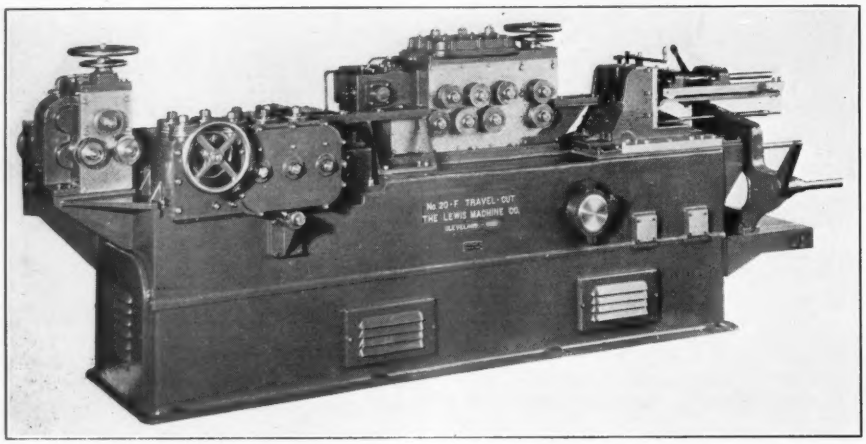
WRITE FOR FURTHER INFORMATION ON "GRANODRAW" AND ON YOUR OWN METAL PROTECTION PROBLEMS.

CHEMICALS ACP PROCESSES

*Fast, Accurate, Economical*

# LEWIS TRAVEL-CUT

## WIRE STRAIGHTENING AND CUTTING MACHINES




Model No. 20-F illustrated. Capacity 3/8" to 5/8" sq. and hex, and equivalent area in flats up to 2" wide 22 other models to handle from .010" to 3/4". Round, hex, flats and shapes.

**Simple in design, rigid in construction, Lewis TRAVEL-CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL-CUT. Full details on request.**

*Exclusive Representatives*

EAST: Penn Machinery Co., 117 North Third Street, Philadelphia 6, Penn.

MIDDLE WEST: Steel & Wire Machinery Co., 15457 Euclid Ave., Cleveland 12, O.

CENTRAL: Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

WEST COAST: Hoffman & Heartt, 3005 So. Grand Ave., Los Angeles 7, California

CANADIAN: Empire Engineering Co., 11 Wellington St. E., Toronto 1, Ontario

CONTINENTAL EUROPE: Gaston E. Marbaix Ltd., Devonshire House Vicarage Crescent, London S. W. 11, England.

## The LEWIS MACHINE Company

**3441 E. 76th Street, Cleveland 27, Ohio**

*Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne*

# WELCOME!

## To CLEVELAND for
## THE WIRE ASSOCIATION CONVENTION

**STANDARD has put out the welcome sign for all visiting wire men, their wives and friends.**

***We will endeavor to help make your convention as pleasant as possible.***

**Come in to see us in our rooms whenever and as often as you can.**

**There will always be someone there to greet you.**

*Call or Write Headquarters or Any Standard Service Center:*

Bruce W. Siemon
2400 Morrow Pl.
Pittsburgh 34, Pa.

John A. Moritz, Jr.
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Chicago 44, Ill.

Earl A. Bowers
5536 Lisette
St. Louis, Mo.

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Caledonia Park
Fayetteville, Pa.

Standard Industrial
Compounds Co.
Millbury, Mass.
Arthur J. O'Mara

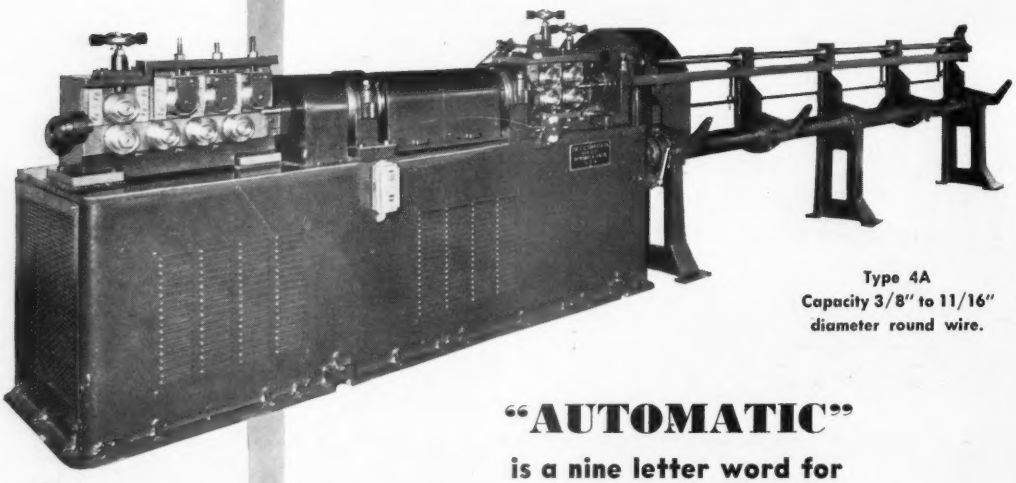
STANDARD INDUSTRIAL COMPOUNDS COMPANY has pioneered most of the outstanding contributions to better wire drawing through better lubricants. Consult with STANDARD for the solution of your difficult problems. We welcome your inquires.

wire drawing lubricants

Standard INDUSTRIAL COMPOUNDS CO., INC.

4600 WEST FERDINAND STREET
CHICAGO 44, ILLINOIS

*"SHUSTER MACHINES are noted for their extremely fast feeds, greater cutting speeds that deliver undistorted, square-cut ends, and for construction that is extremely rigid and wear resisting."*



Type 4A
Capacity 3/8" to 11/16"
diameter round wire.

# "AUTOMATIC"

**is a nine letter word for**

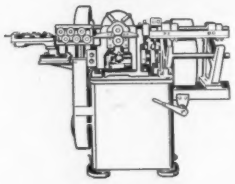
# SHUSTER

## WIRE STRAIGHTENERS & CUT OFF MACHINES

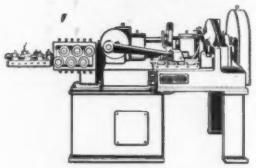
**Round wire, flat, square or hexagon stock, tubing—all are straightened and cut faster, more accurately and more economically because of SHUSTER automatic features.**

**Each operation of the machine is perfectly integrated, delivering straight, exact lengths with square, clean-cut ends.**

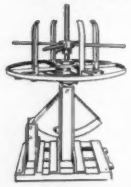
**There is a SHUSTER for every wire straightening job from .025 to 11/16" diameter. Write today for our recommendation, describing your needs. No obligation whatever.**



FLAT STOCK STRAIGHTENERS

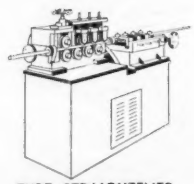


SLIDE FEED STRAIGHTENERS

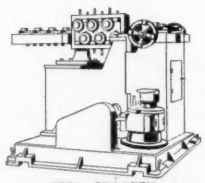


REELS

**Write for data on these two New SHUSTERS!**



TUBE STRAIGHTENER



FEED STARTER

# SHUSTER

*Automatic*

*Since 1866*

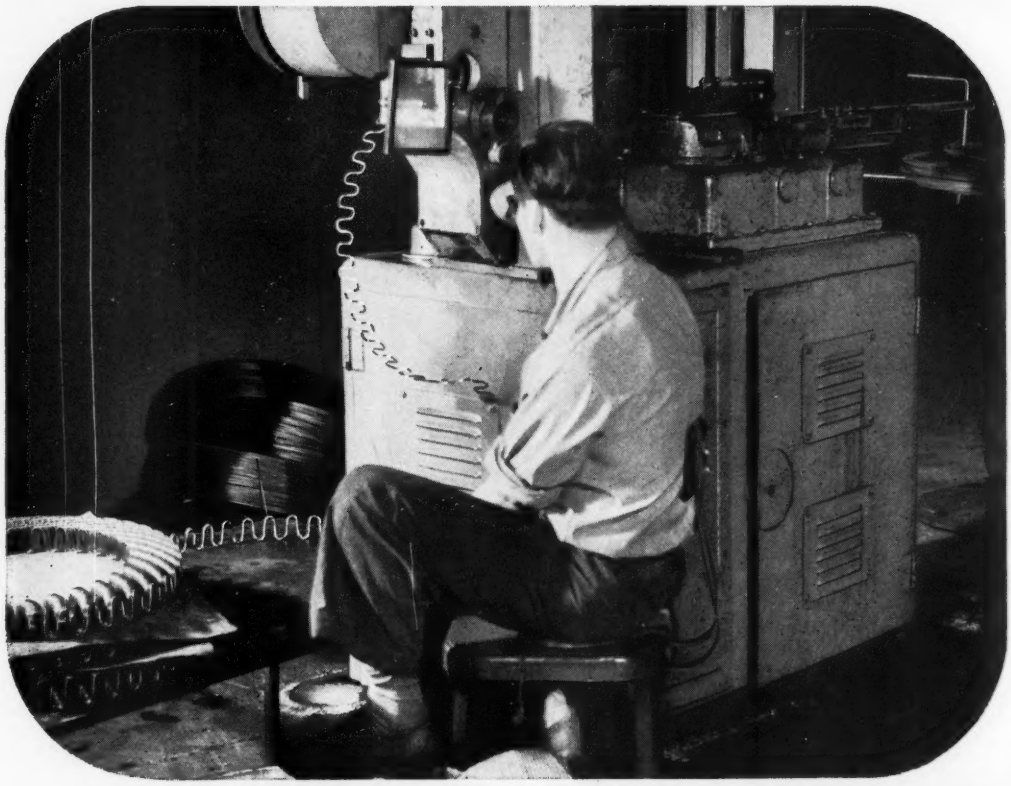
**WIRE STRAIGHTENING AND CUTTING MACHINES**

**Mfd. by METTLER MACHINE TOOL, INC.**

**132W Lawrence St. New Haven, Conn.**

*Representatives in all principal cities and foreign countries.*

# SPRING WIRE



## *For uniform quality, we're sure this spring wire is the best we've ever made*

ROEBLING is about the largest specialty wire manufacturer in America. And with progressively improved facilities and more positive controls we are constantly turning out wires with a higher uniformity of gauge, finish and mechanical properties.

Among these products that save preparation time and boost production for users are mechanical spring wires including hard drawn, soft, annealed or oil-tempered M.B., H.B. and Extra H.B.; music wire; upholsterers' spring wire and valve spring wire...all in a full range of physical properties and finishes.

Reduce your machine shut-downs and step up overall production with the Roebling specialty wire that will meet your most exacting requirements. John A. Roebling's Sons Company, Trenton 2, N. J.

**ROEBLING**

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, N. J.

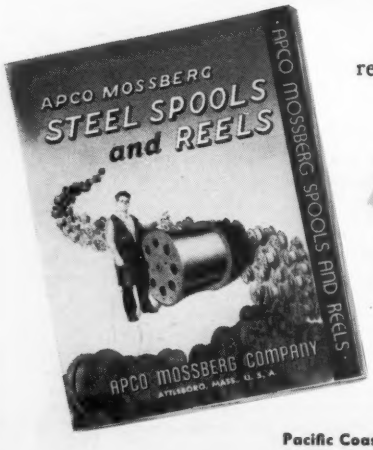
# APCO MOSSBERG COMPANY

*welcomes members and guests of the Wire Association*

## Engineered Steel Reels and Spools for Every Purpose

Whatever your problem in steel reels, spools and bobbins—Apco Mossberg Engineers will work out a solution based on over a half-century of experience.

The Apco Mossberg plant is fully equipped to handle your special requirements, if standard types are not suitable for your use.




**WRITE FOR ILLUSTRATED BROCHURE CONTAINING USEFUL INFORMATION ON APCO MOSSBERG SPOOLS AND REELS**

## APCO MOSSBERG COMPANY

(The original Frank Mossberg Co.)

**Manufacturers of steel spools and reels for over 55 years**

## ATTLEBORO, MASSACHUSETTS, U.S.A.

**Pacific Coast Representative**
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CONTINENTAL STEEL CORP.
STEEL
*CONTINENTAL
REG. U.S. PAT. OFF.
WIRE
KOKOMO, IND.

# It Pays to Take Advantage of *CONTINENTAL'S WIRE SERVICE

Why should you spend your time and money—trying to find a wire to meet some product need? Let Continental help you! The right wire can help cut product costs . . . can improve performance and product life. Users who depend on Continental know they are getting wire with a good service record. It will pay you to check with Continental for the wire you need . . . and for helpful wire service. Call Continental when you have your next wire problem.

*Trade Mark Reg. U. S. Pat. Off.

CONTINENTAL STEEL

# CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF *Manufacturer's Wire* in many sizes, shapes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, Lead Coated, and special wire. ALSO, Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.

# THE MONTGOMERY COMPANY

ESTABLISHED 1871

50 CANAL STREET

WINDSOR LOCKS, CONNECTICUT

## BARE ELECTRICAL TINSEL CONDUCTORS

in long lengths, ready for insulating with textile rubber and plastic.
Used in Cord Sets for:
Telephones — Radios — Electric Razors — Hearing Aids.
Used Bare for Voice Coil Lead Wires

*Above meets U/L Standards*

## SILVER COATED COPPER WIRE

To ASTM Specifications for UHF Cables and
Hook-up Wire to Government Specifications.

## TINSEL LAME (FLAT WIRE)

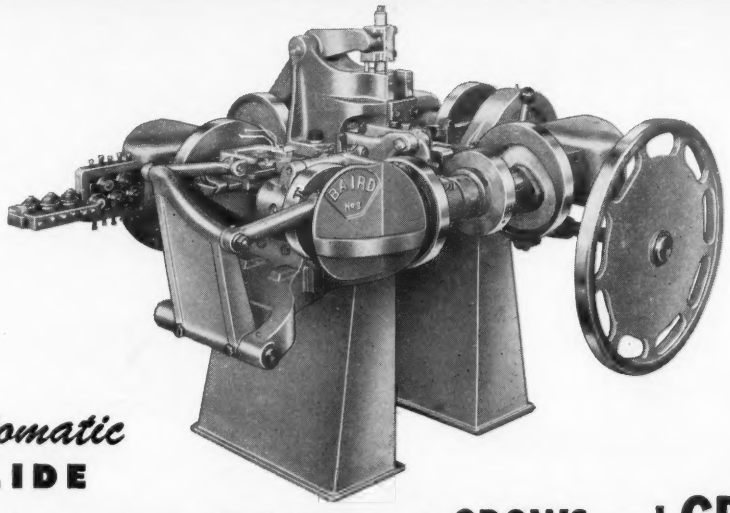
Silver Plated and False Gold Coated for
weavers of tinsel ribbons and garlands.

## "NEVA-TARN" GOLD & SILVER TARNISH PROOF YARNS

Plain, Supported or made into Novelty
yarns. For knitters and weavers of dress,
upholstery and drapery fabrics.

# ASK BAIRD ABOUT IT!

## HIGH PRODUCTION TOOLING




**BAIRD *Automatic***
**FOUR SLIDE**

## . . . the Machine that GROWS and GROWS and GROWS

Start, if you wish, with the standard (stocked) 4-slide, which in itself is remarkably versatile in forming hundreds of articles from wire and ribbon metal.

Then when conditions demand . . . a call for even greater versatility of production or a change in certain products . . . you may add one or more attachments to the standard model, so designed that "machine growth" is simplified and practical.

Thus, with gradual investments, you will build your Baird 4-slide to a full production unit capable of turning out the widest variety of wire and ribbon products. Here is a list of attachments easily added . . . but naturally, not all on one machine . . . as they might become too complicated.

1 Horizontal Press Attachments

2 Form Raising Attachment

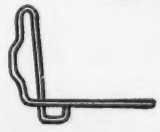
3 Pin Pulling Attachment

4 Round Wire and Ribbon Metal Rings
(Simple, practical tooling available)

5 Secondary Cut-Off Attachment

6 Pinch Pointing — Nail Pointing
(Tooling to suit work and wire specifications)

7 Vertical Forming and Stripping
(New patented Baird mechanism for this work)

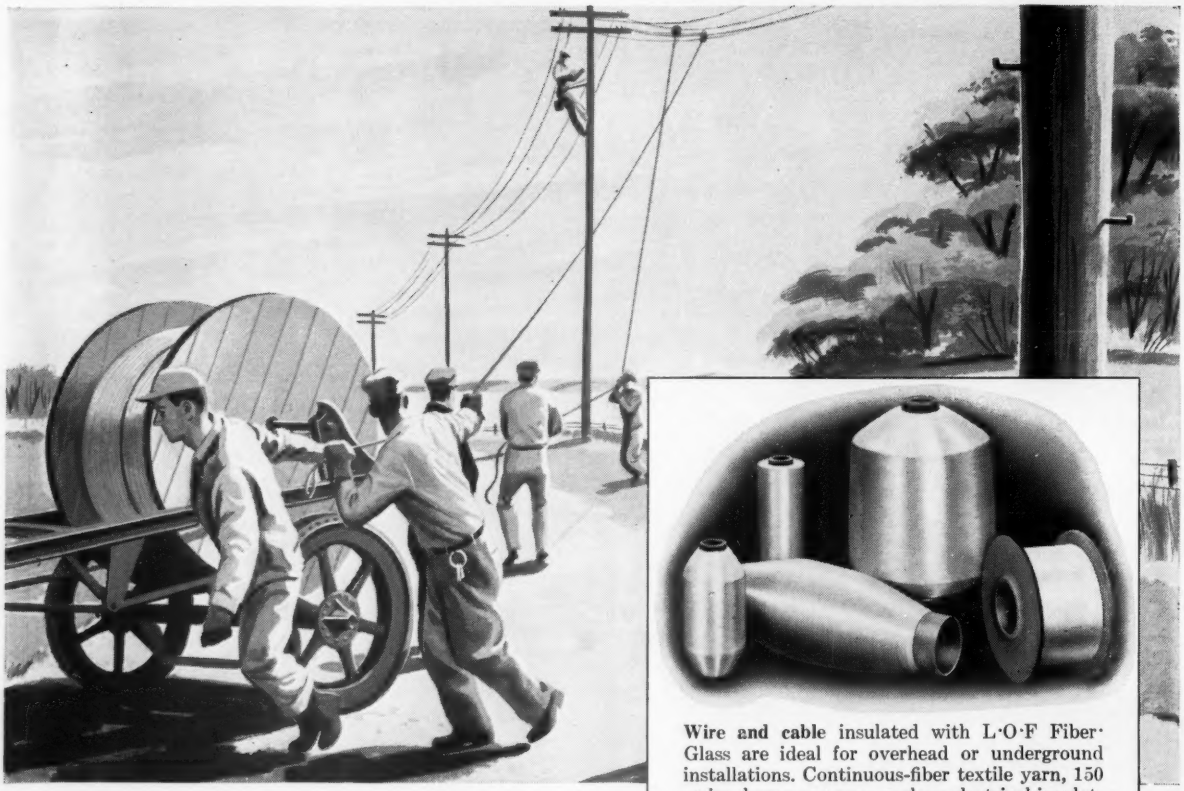


*Baird engineers will gladly develop tooling from your parts or specification. "Ask Baird about it!"*

**the BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

**AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS**

4BA52



**Wire and cable** insulated with L·O·F Fiber·Glass are ideal for overhead or underground installations. Continuous-fiber textile yarn, 150 series, has many uses, such as electrical insulating tape and sleeving. High dielectric strength. Withstands temperatures up to 800° F.

# Insulated wire cable resists heat, moisture, cold

**Libbey·Owens·Ford adds quality Fiber·Glass insulation to long list of glass products**

THE HIGH insulating efficiency of L·O·F Fiber·Glass permits greater compactness in design of wire and cable. It also allows them to withstand a wide range of temperatures and humidities.

Fiber·Glass is durable, too. It is unaffected by contact with moisture, oils, most acids and corrosive vapors. And when properly impregnated as a base for heat-resisting electrical varnishes, it has a substantially higher insulation resistance than most other textiles.

You will find that L·O·F Fiber·Glass meets a wide variety of applications, whether you make wire, cable, motors, generators, sleeving, magnet wire. Fiber·Glass yarn can be woven into cloth and tape, braided or wrapped on fine wire and plied or cabled into flexible cords.

If you'd like to talk about uses of Fiber·Glass in the electrical field, contact the nearest L·O·F office (district offices in 25 major cities). Or write, wire or phone Libbey·Owens·Ford, Dept. F·G 26102, Nicholas Building, Toledo 3, Ohio.

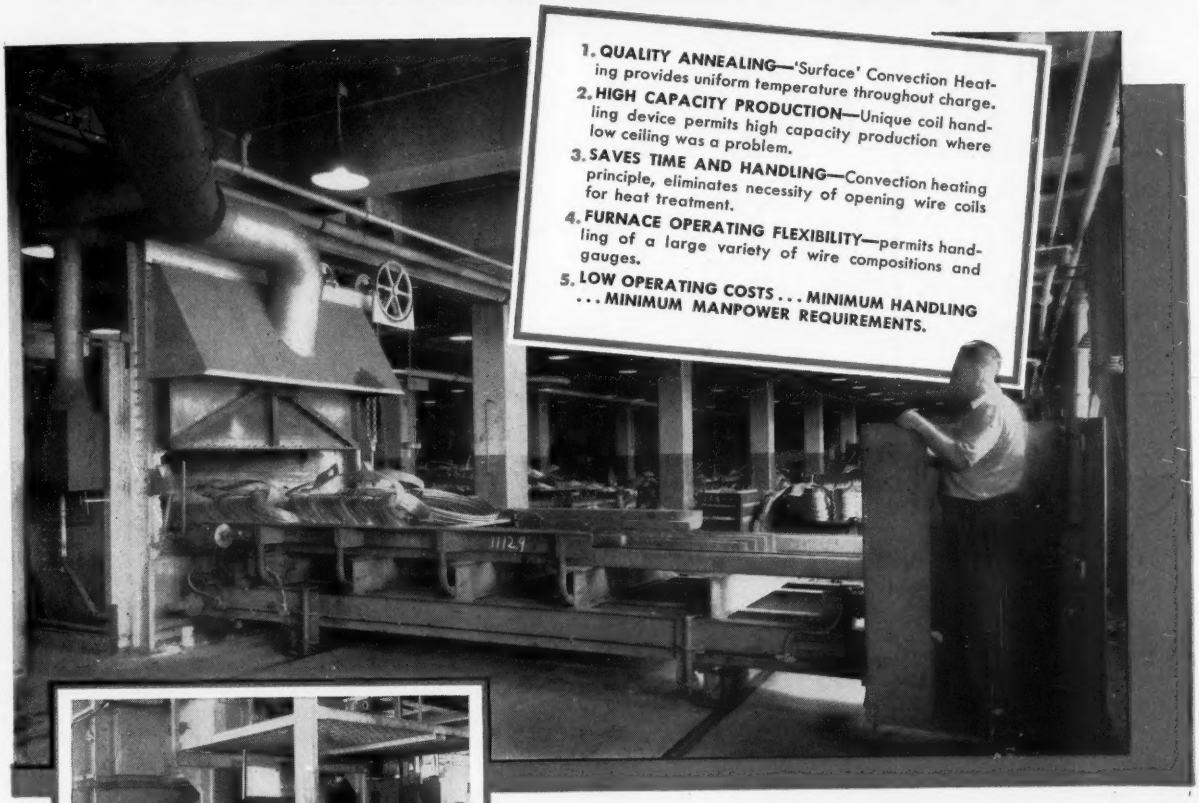
L·O·F GLASS · PLASKON · FIBER·GLASS

**LIBBEY·OWENS·FORD GLASS COMPANY**
FIBER•GLASS DIVISION

**FIBER·GLASS**

# 'Surface' WIRE ANNEALING FURNACE

## . . . meets unusual production requirements



1. **QUALITY ANNEALING**—'Surface' Convection Heating provides uniform temperature throughout charge.
2. **HIGH CAPACITY PRODUCTION**—Unique coil handling device permits high capacity production where low ceiling was a problem.
3. **SAVES TIME AND HANDLING**—Convection heating principle, eliminates necessity of opening wire coils for heat treatment.
4. **FURNACE OPERATING FLEXIBILITY**—permits handling of a large variety of wire compositions and gauges.
5. **LOW OPERATING COSTS . . . MINIMUM HANDLING . . . MINIMUM MANPOWER REQUIREMENTS.**

*Rear view of 'Surface' Annealing Furnace showing high speed—high capacity recirculating fan used for convection heating. This assures maximum speed and uniformity of heating.*

*The many 'Surface' Heating Installations, whether convection heating, direct-fired or controlled atmosphere, have proved their economy in operation.*

Quality heat treating, at a production rate to keep pace with high volume drawing operations, was made possible in this low-ceiling building with the use of the highly-efficient 'Surface' Convection Furnace shown above. This furnace is equipped with a unique materials handling mechanism. Non-ferrous wire coils are sling-loaded on to an alloy charging tray which is moved in and out of the furnace on roller rails.

Non-ferrous wire is heat treated at rates of 2500 lbs. net, and upwards per hour. Temperature range up to 1250°F.

This is a typical example where 'Surface' personnel worked in cooperation with company management and engineers to design heat treating equipment in keeping with plant production needs. If you have a special heat treating problem for non-ferrous or ferrous materials, for any required temperatures, it will pay you to discuss it with a 'Surface' representative. No obligation.

**SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO**

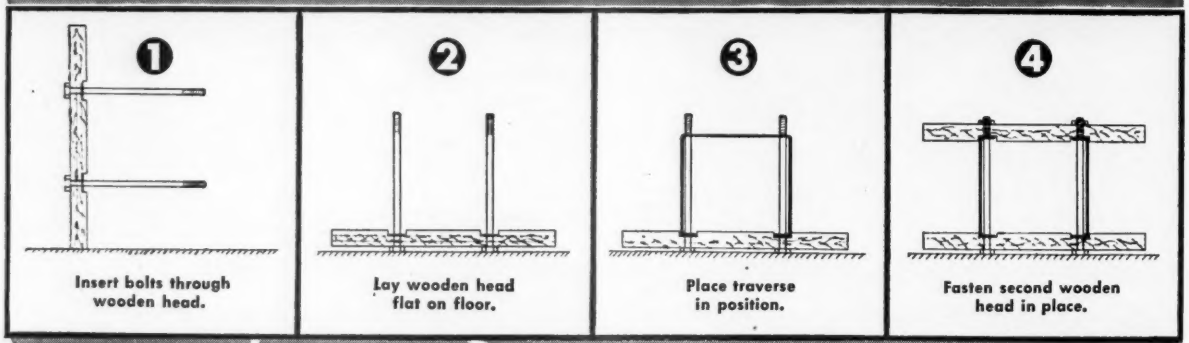
*FOREIGN AFFILIATES: Stein & Roubaix, Paris — British Furnaces, Ltd., Chesterfield*

'Surface'

**INDUSTRIAL FURNACES**

FOR: Gas Carburizing and Carbon Restoration (Skin Recovery), Homogeneous Carburization, Clean and Bright Atmosphere Hardening, Bright Gas-Normalizing and Annealing, Dry (Gas) Cyaniding, Bright Super-Fast Gas Quenching, Atmosphere Malleableizing and Atmosphere Forging. Gas Atmosphere Generators.

# Save Time • Labor • Space • Money through this simple 4-Step Assembly of NILES Flanged Steel Traverses



Niles Flanged Steel Traverses save time . . . because they require only four simple steps in reel assembly. They save labor . . . no special tools are necessary. They may be stacked and stored in a minimum amount of room . . . thus saving space. And they save money by providing long service life. Actual experience records show that Niles Flanged Steel Traverses have given as much as sixteen year's service–without refinishing or major maintenance. In many cases their use has doubled the number of trips per reel before cut downs or scrapping of wooden heads.

Niles "Reinforced Type" Steel Traverses have *extra strength* where it is needed most–at bolt holes and base of flange. Reinforcing makes possible the use of lighter gauge steel, saving up to 20% in weight while increasing overall length.

Sizes of Niles Flanged Steel Traverses range up to 56″ diameter and 48″ traverse. Finishes include plain, painted and hot dip galvanized. Width of flange and number of bolt and drain holes can be furnished to your specifications. Write today for prices.

**NILES STEEL PRODUCTS DIVISION**
**REPUBLIC STEEL CORPORATION**
**NILES, OHIO**

REPUBLIC STEEL

**NILES**
**FLANGED STEEL TRAVERSES**

# L. R. Kerns Company

INDUSTRIAL LUBRICANT SPECIALISTS

*Quality* *Service*

## "Wire-Film" Drawing Compounds

POWDERS • PASTES • SOLUBLES

for

STEEL — ALUMINUM — COPPER

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## "Mor-Film" Cling Oils—Greases

for

NAIL MACHINES • HEADERS • WIRE ROPE

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## "Safe-Film" Rust Preventives

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EVERY TYPE OF PROTECTION

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## Depend on **Kerns** *experience and know-how* in solving *your* lubricant problems

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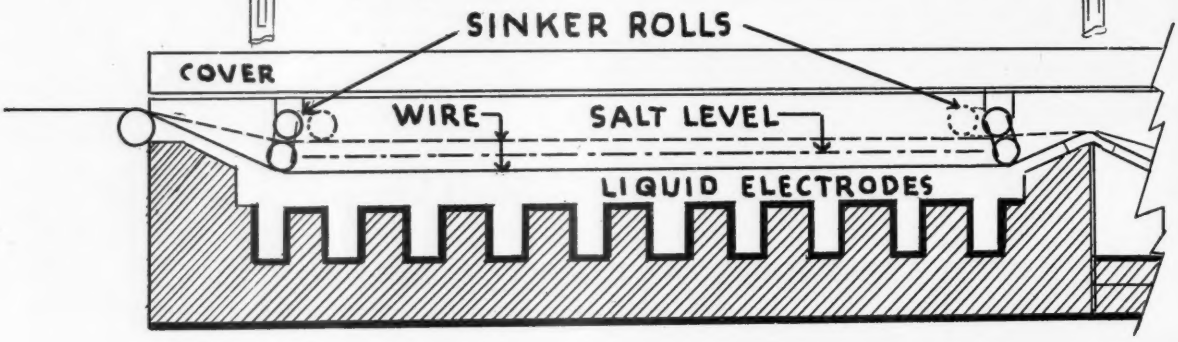
Warren 4405-6

# SCALE — FREE

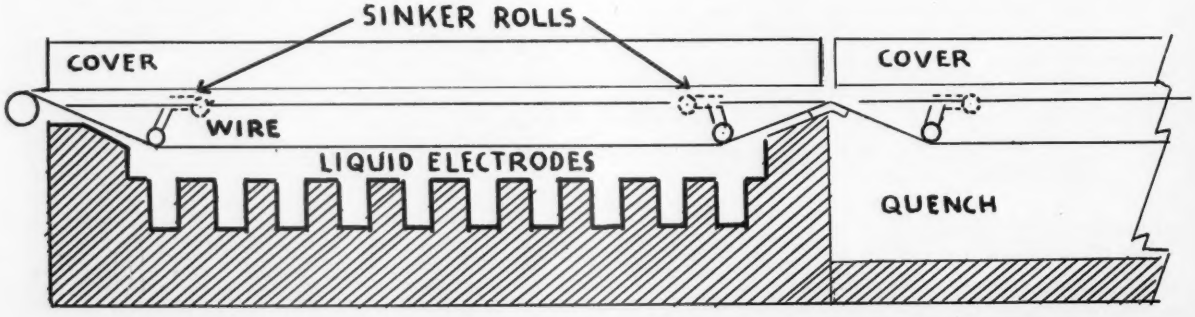
Holden Liquid Electrode Furnace covered by U. S. Patent #2512206. Salt baths for both high heat and quenching furnaces covered by two U. S. patents issued. Other patents pending.




## PROCESS OPERATIONS:

1. Wire passes through a high temperature salt at from 1500 to 1700° F.
2. Wire travels into a quenching furnace operating at from 800 to 1000° F.
3. Wire enters first water wash station which maintains a salt content approximating 5% to 20% in water solution.
4. Wire passes to second washing station, where a zinc phosphate coating is formed on the wire to act as a vehicle for carrying soaps or other lubricants.
5. Hot water tank dissolves off any soluble salts. These go to drain.
6. Drying station is optional—depending on size of wire.

## *WRITE FOR DETAILED INFORMATION*



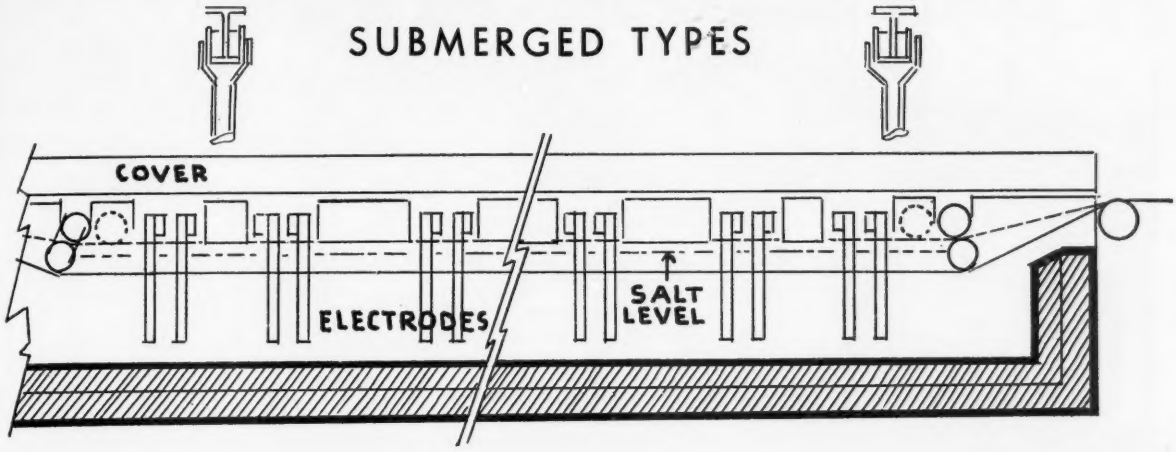

# THE A. F. HOLDEN COMPANY

P. O. Box 1898
New Haven 8, Conn.

11300 Schaefer Highway
Detroit 27, Michigan

# WIRE PATENTING

## SUBMERGED TYPES




## BENEFITS OF PROCESS:

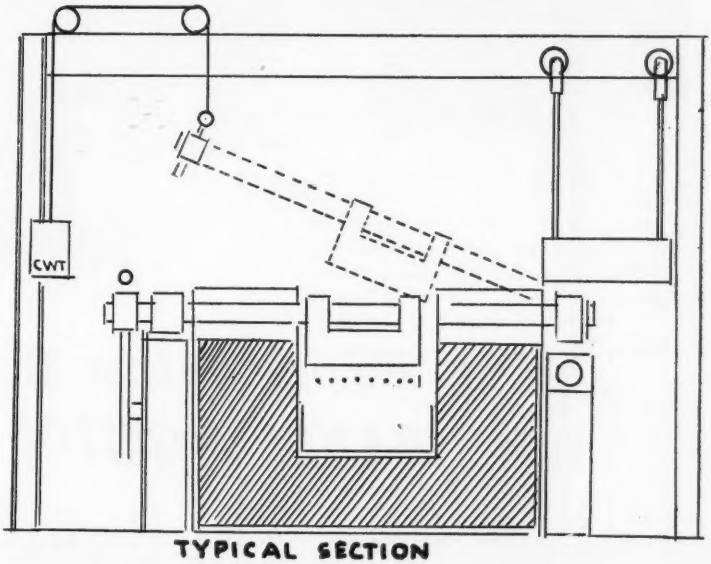
...Complete elimination of acids.

...No lime coating or other alkali agents required.

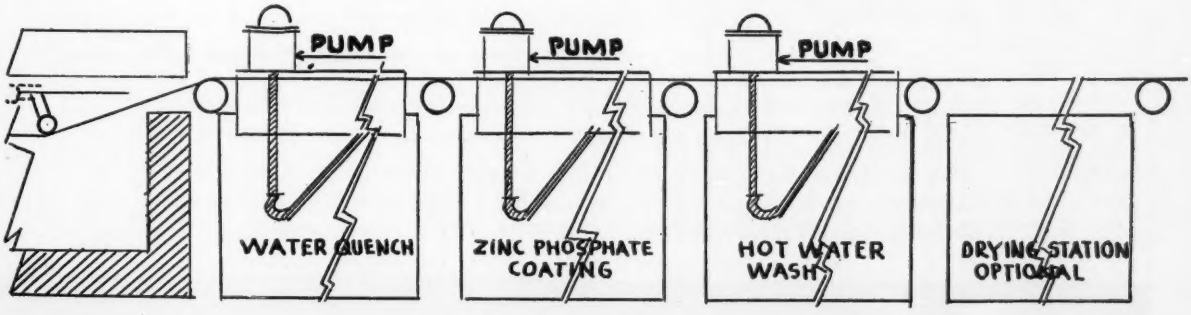
...No hydrogen embrittlement.

...Less float of wire required to operate a plant where wire can go directly from takeoff blocks to draw bench.

...Manufacturing costs are no greater —and usually lower—than present methods.




TYPICAL SECTION




# THE A. F. HOLDEN COMPANY

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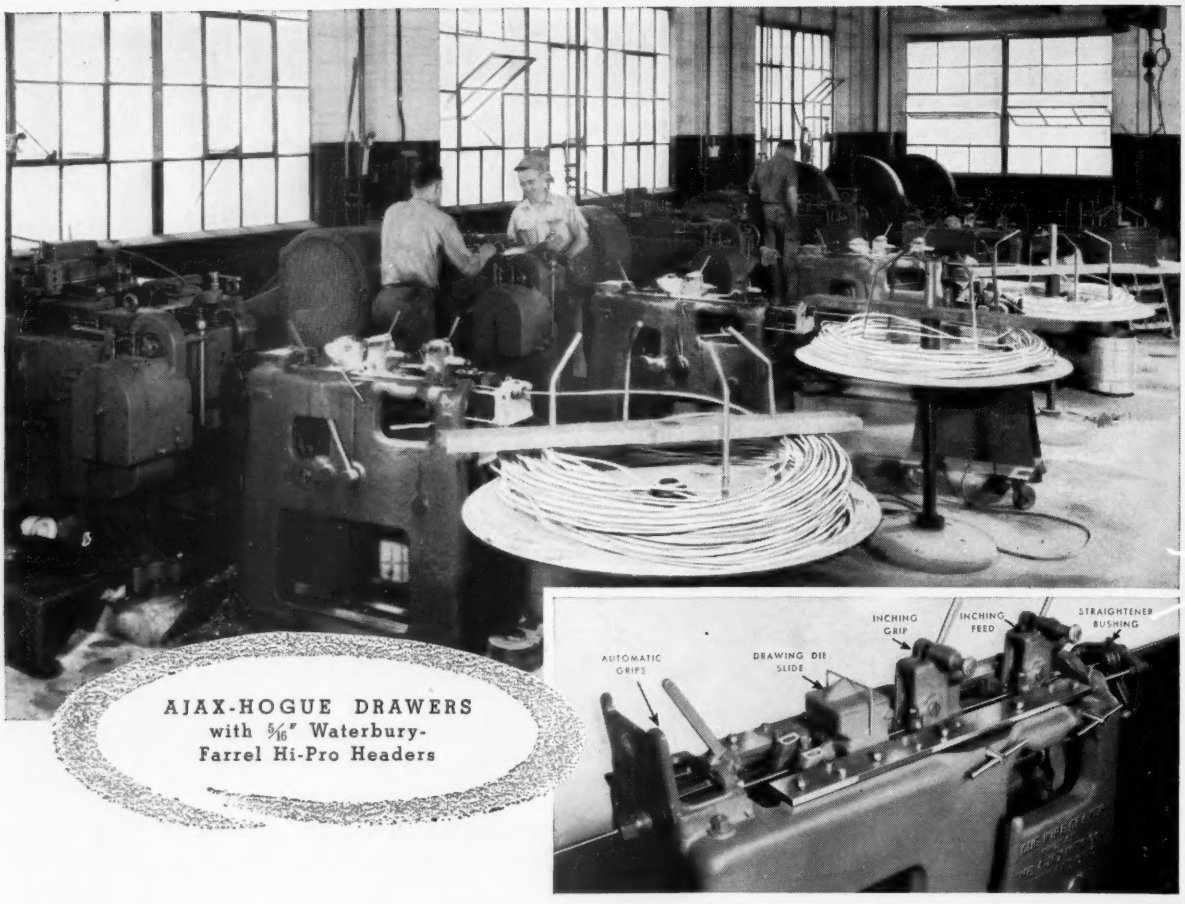

AJAX-HOGUE DRAWERS
with 5/16" Waterbury-
Farrel Hi-Pro Headers




# *High Production Heading with AJAX-HOGUE Drawn Wire*

Progressive bolt manufacturers throughout the country are achieving greater efficiency and lower production cost with Ajax-Hogue wire drawers coupled to their headers.

Hogue drawn clean, straight, accurate to size wire eliminates almost all of the avoidable down time, saves much of the wear on the header dies, makes it easily possible to change the wire size to meet requirements. It also effects a saving in the cost by using hot rolled rod instead of more expensive mill drawn wire.

If you operate any headers, regardless of make, which are not equipped with Ajax-Hogue wire drawers write for Bulletin No. 111 in order to learn more about the advantages of these drawers.

THE Ajax MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
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DEWART BUILDING NEW LONDON, CONN.

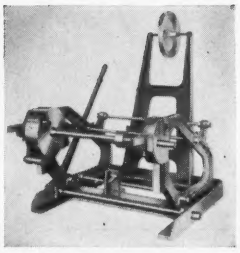
# FOR FASTER, MORE UNIFORM EXTRUDING

## ...DAVIS-STANDARD EXTRUSION EQUIPMENT

Famous for a background of long, sound experience, Standard Machinery has engineered a line of extruding machines and auxiliary equipment that is preferred everywhere. It includes equipment for special-purpose applications.

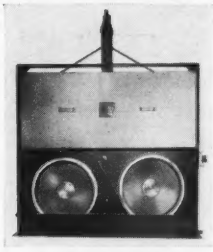
Our equipment for *complete, continuous vulcanizing in all sizes* is outstanding for its many production advantages. Also, we design and manufacture head and stock screw units, thermo-plastic insulating equipment and other equipment for specialized jobs. Featured here are three of our finest accessory units.

***Tell us your equipment needs or problems. Our engineers will cooperate with yours to give the best installation for your operation.***



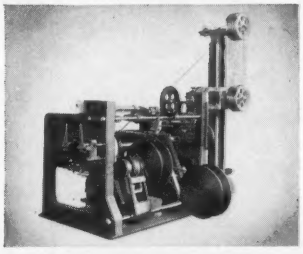
### PAY-OFF

**Unit is equipped to take reels up to 36" and 48" in diameter. Reel lift from floor is by cam-and-lever. Mechanism is automatically self-braking; brake is actuated by any slackening of wire speed. Rugged construction.**



### DAVIS-STANDARD CAPSTAN

**Supplied in wide range — drag and pulling type, for almost all wire plant needs. Aluminum or cast iron drums, grooved or flat — any radii desired. Standard drum sizes 16", 24", 32", 48" and 60". Gear reducers standard, four speed transmission optional.**



### NEW, IMPROVED TAKE-UP OUTMODES OLD TYPES

**Great, new efficiency. Noise- and vibration-free. No gears or clutches. Built to operate positively at high speeds. Reel drive by multiple double V-belts. Automatic brake. Totally new traverse mechanism. Speed range choice provided for constant tension control. For reels 6" to 36", larger sizes custom-built.**

## THE STANDARD MACHINERY COMPANY

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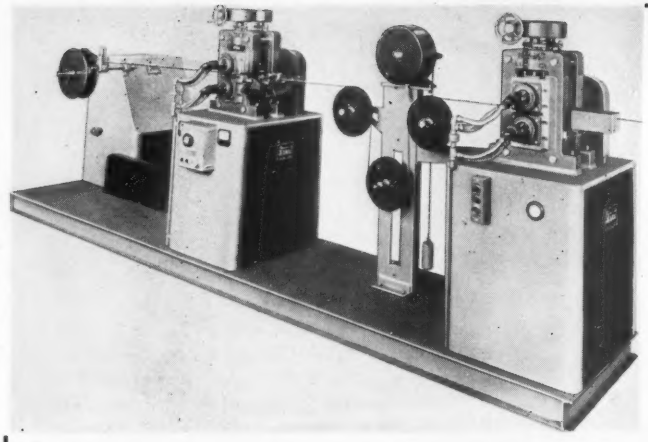
***MOLDING PRESSES AND EXTRUSION MACHINES***

***World's Largest Manufacturers of Custom-Built Extrusion Machines***

**Export Office: Ballagh & Thrall, Independence Square, Philadelphia 6, Pa.**



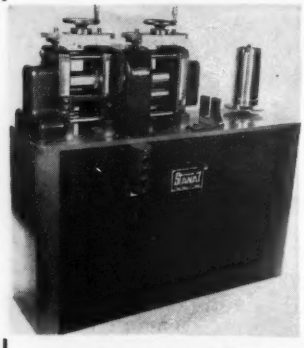
***STANAT*** *MODEL T-400 WIRE FLATTENING MILLS. Water Cooled —— Stepless Speed Adjustment —— Automatic Wire Tension —— Accuracy —— Speed —— Ease Of Changeover —— Low Operating Cost.*

STANAT

# METAL FORMING EQUIPMENT

—— for ——

## PRODUCTION and LABORATORY

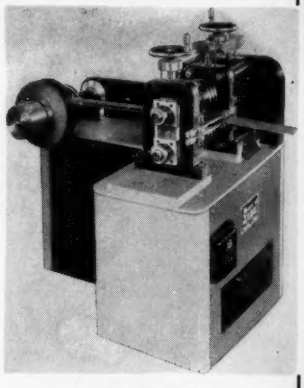


#CBB-100 FLAT and WIRE MILL WITH BULL BLOCK

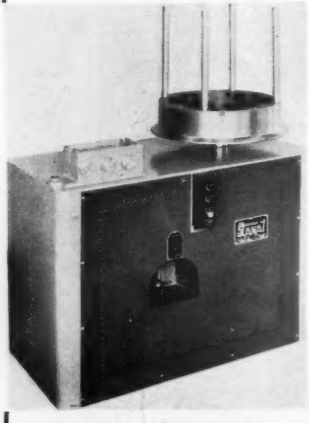
Equipment for research and laboratory use is given the same consideration as high production units.

***STANAT*** builds 2 high, 4 high, and tandem mills, breakdown and laboratory mills, recoilers, pay-offs, slitters, roll formers, bull blocks, sheet and strip straighteners, rolls and many special types of wire and accessory equipment.

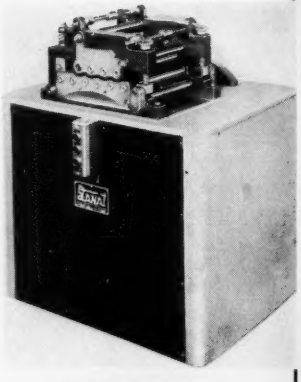
***AND—STANAT*** BUILDS THIS EQUIPMENT TO MEET YOUR REQUIREMENTS.



#S-180 SLITTER



#BB-22 BULL BLOCK FOR WIRE DRAWING



#RL-12 STRIP STRAIGHTENER

***CONSULT***

STANAT

**MANUFACTURING COMPANY**

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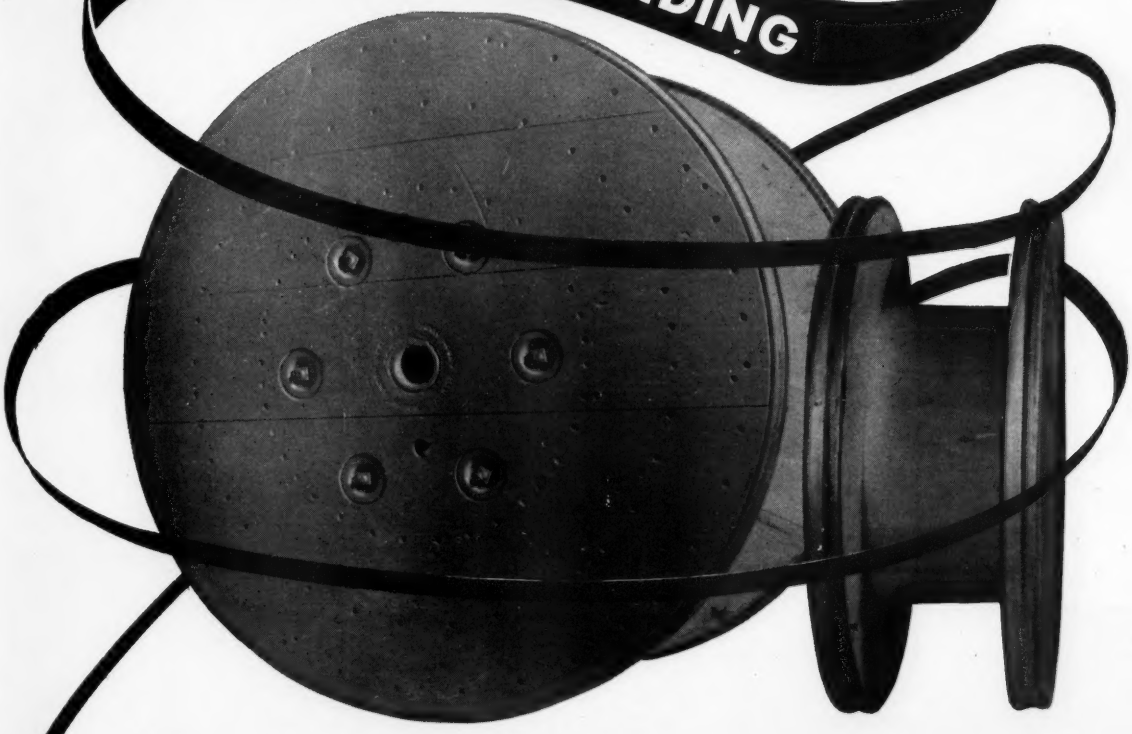
LONG ISLAND CITY, N. Y.

OUR ENGINEERING DEPARTMENT FOR TECHNICAL SUGGESTIONS REGARDING YOUR PROBLEMS.

# WRAP UP YOUR REEL TROUBLES WITH A METAL BINDING



*You Can:*

## REDUCE REEL COSTS • INCREASE REEL LIFE and ELIMINATE REEL REPAIRS with NARCO

**METAL BOUND REELS**

These fine, long-lasting reels will do all of the above and show savings of up to 300% in reel costs.

For example, a standard all-wood reel will average *four* trips with repairs. A NARCO METAL BOUND REEL of the same size will give you *twelve to sixteen trips* — with *NO REPAIRS*. And yet a sturdy, well-made NARCO Reel averages only 50% more in cost to you.

Available in 12″ through 48″ diameters. All-wood reels made from 12″ to any diameter. Shipped assembled or knocked-down, as desired.

May we quote on your requirements?

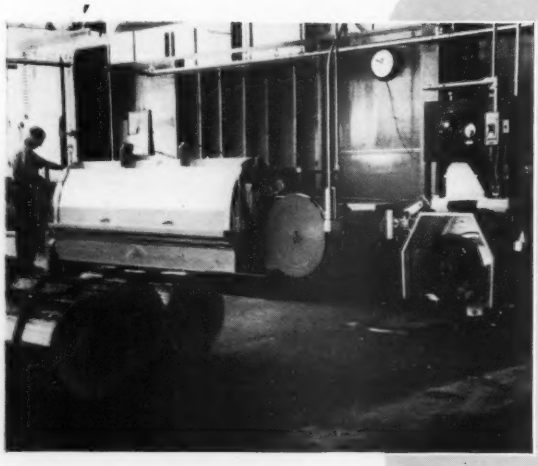
**North Anson Reel Co.**

TELEPHONE MADISON 187-2 NORTH ANSON, MAINE

*Symbol of Integrity and*

SYN

*Better Machinery for*



Heavy Duty Rod Breakdown Machine for high speed non-ferrous wire drawing.

**We are proud to have been associated with the Wire Industry over the past years and are gratified in realizing that we have contributed, through the medium**

**SYNCRO MACH**

PERTH AMBOY • NEW JERSEY • USA

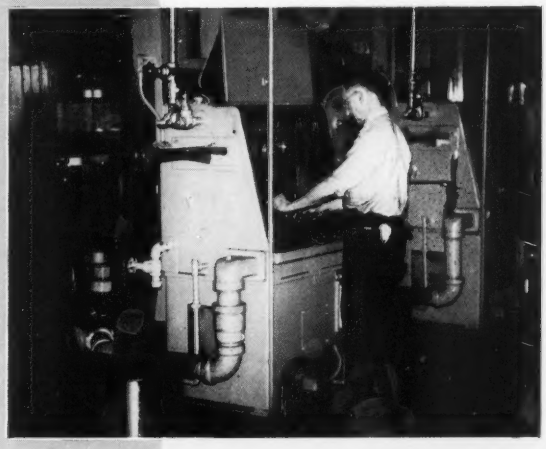
WIRE DRAWING MACHINES • STRANDERS • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS •

A-226

# Achievement . . .

## the Wire Industry

of producing machinery, to the development of an Industry that today is in such prominence and so vitally important to our standard of living.



Fine Wire Drawing Machinery for high speed non-ferrous wire drawing.

**I N E  C O M P A N Y**

Affiliated Co: WINGET-SYNCRO, Ltd • Rochester • Kent • England

• PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKE-UPS • TAPERS • SPECIAL MACHINERY

THERE'S A **FAST, DEPENDABLE**

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## SERVICE TO FIT *any* DRAWING DIE NEED

**WIRE • BAR • TUBING • SHAPES • DEEP DRAW**

UNION serves the wire drawing industry with EVERYTHING FOR THE DIE ROOM. That's a real money-saving convenience—but even more important, every UNION product is the FINEST in its field—tested and accepted as the best—anywhere. UNION's service, quality and technical know-how add up to REAL economy for the die rooms we serve so completely.

**CARBIDE DIES**
& RECUTTING

**DIAMOND DIES**
& RECUTTING

**DIAMOND POWDER**
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**RECLAMATION OF DIAMOND POWDER**
FROM DIE ROOM WASTE

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IN TUBES, JARS OR CARTRIDGES

**MACHINERY**
FOR ALL DIE ROOM OPERATIONS

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# UNION WIRE DIE CORP.

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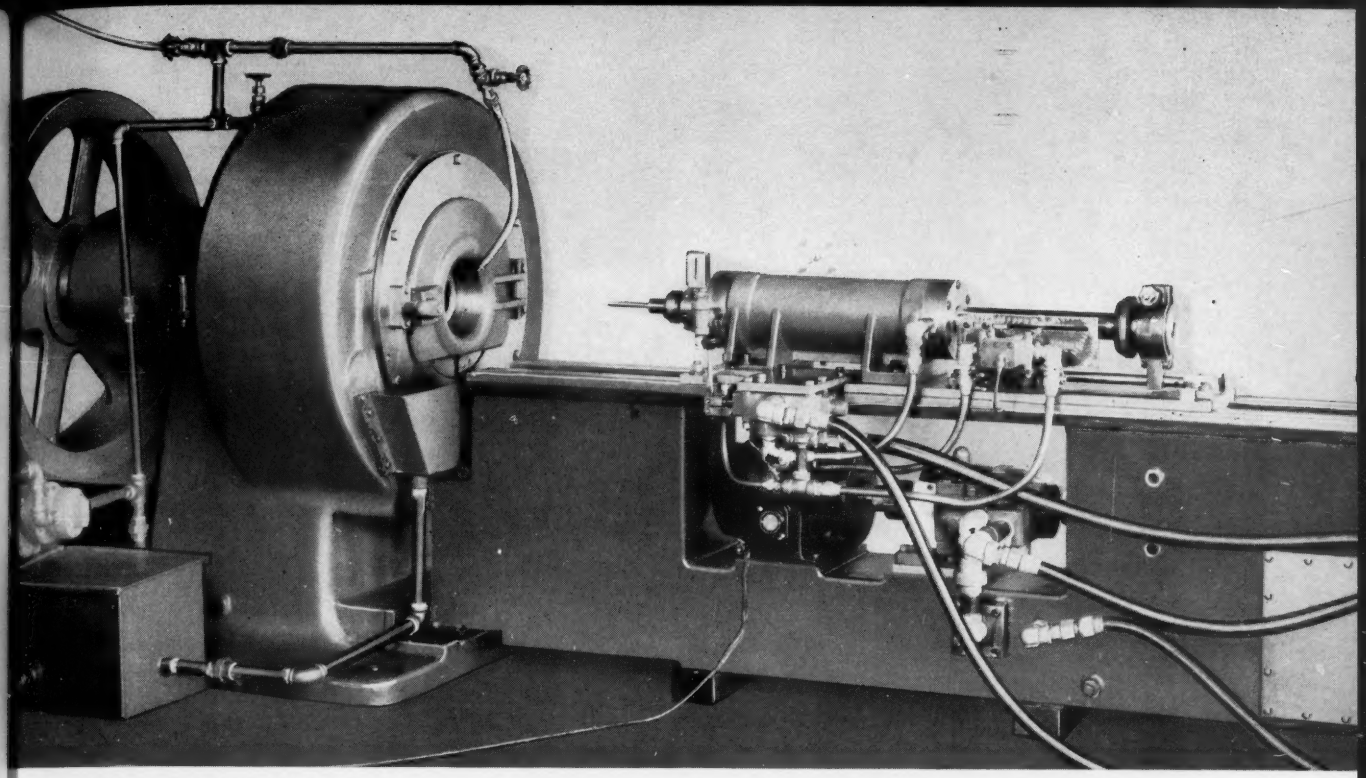


**FENN SWAGING MACHINE,** featuring hydraulic feed, automatic chucking, and oil-cooled dies, is fast replacing lathes and screw machines for shaping a wide range of metal parts because it . . .

# MAKES METAL GO TWICE AS FAR

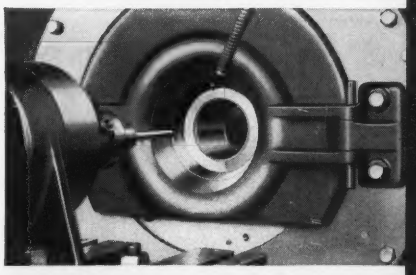
Yes, you can cut your metal requirements in half, in many cases, with this Fenn Swaging Machine. That's because it doubles the length of the blanks it shapes . . . with absolutely no stock removal.

### *MANY OTHER ADVANTAGES*

What's more, this Fenn Swager produces a denser structure in metal parts . . . maintains concentricity . . . gives an improved finish . . . requiring no subsequent grinding . . . calls for less operator skill than any other machine capable of producing equivalent parts.

### *WRITE FOR SPECIFICATIONS*

It will pay you to investigate all the cost-cutting, material-saving advantages of the Fenn Swager. Contact the Fenn distributor nearest you for facts and delivery schedules, or write direct to THE FENN MANUFACTURING COMPANY, 1853 Broad St., Hartford 1, Conn.



**SIMPLE DIE CHANGES,** using blanks in various diameters, make Fenn Swaging Machines quickly and easily adaptable to a wide variety of jobs. You can use them for reducing, pointing, or forming bar stock or tubing. Also for assembling fittings to cables. Fenn Swagers and Hydro-Formers come in sizes and designs for every swaging need.

**FENN**

*Shaping metal for better and stronger products at lower cost*

**FENN MACHINES ARE SOLD BY:**

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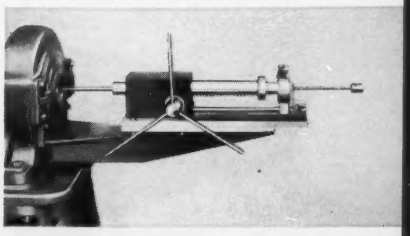


**FENN FEEDING DEVICES,** either manually or hydraulically operated, are available for all sizes of swagers. They speed up production and reduce operator fatigue.

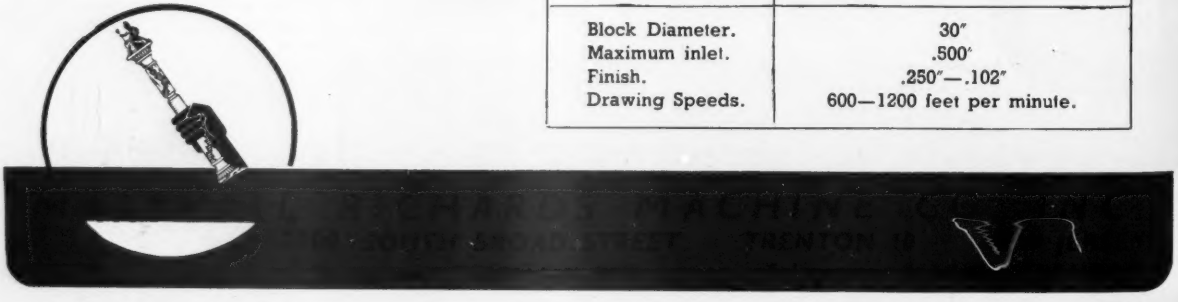
# THE PATHFINDER

## A straight through non-slip machine of advanced design

*Special 4/5 Block Pathfinder Type 22/40 for drawing mild steel from 5 s.w.g. at speeds up to 2,250 feet per minute.*

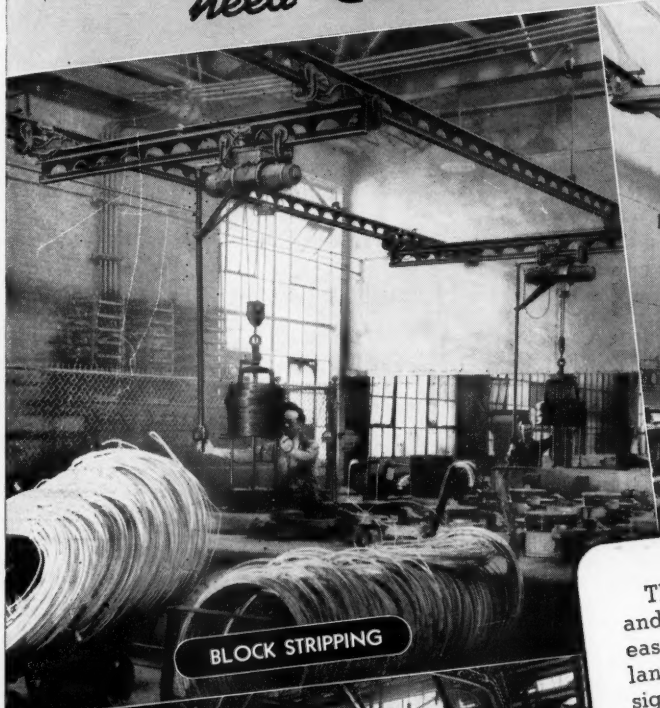
1. The wire passes straight through the machine from block to block. The block speeds are automatically regulated by our patented electrical gear. Wire tension between blocks can be independently set.
2. Tilted blocks enable sufficient wire to be accumulated on each block to allow for ample cooling and yet pass through the die to the bottom of the following block in a straight line.
3. Almost infinite drafting can be obtained at each die.
4. The machine is ideal for use with a heavy spooler carrying up to about two tons of finished wire.
5. Owing to the absence of all guide pulleys, multi-holing from very heavy inlets is perfectly feasible.
6. A standard FIVE BLOCK Heavy machine is available for high carbon with the following specification:

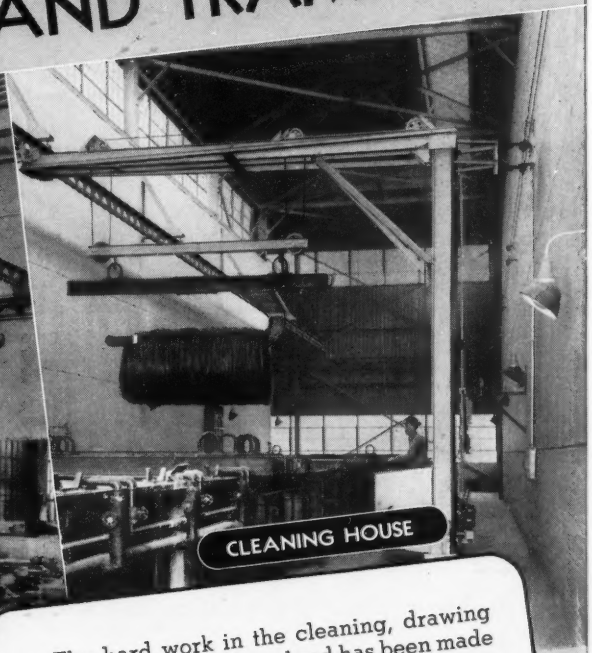
| | Type 30/60 |
|---|---|
| Block Diameter. | 30" |
| Maximum inlet. | .500" |
| Finish. | .250"—.102" |
| Drawing Speeds. | 600—1200 feet per minute. |



MR50

# ROD AND WIRE PLANTS *need* CLEVELAND TRAMRAIL



The hard work in the cleaning, drawing and handling of wire and rod has been made easy, fast and safe by application of Cleveland Tramrail equipment especially designed for the work.

Perhaps no other single factor has been so influential in increasing production and lowering costs in the wire or rod mill as properly designed and applied overhead materials handling equipment.

Today more producers and fabricators of wire and rod are enjoying the many advantages of Cleveland Tramrail than ever before and the list of prominent names in this industry is growing rapidly.

It costs you nothing to learn what Cleveland Tramrail can do for you, but it may be of tremendous importance in the immediate years ahead. Why not investigate now?

***GET THIS BOOK!***
BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

**CLEVELAND TRAMRAIL DIVISION**
THE CLEVELAND CRANE & ENGINEERING CO.
9209 East 288th St. Wickliffe, Ohio

**CLEVELAND TRAMRAIL**
**OVERHEAD MATERIALS HANDLING EQUIPMENT**

# These Advantages Are Yours...

# CONSISTENT FOLLOW-THROUGH
# EFFECTIVE SLIP
# TENACIOUS FILMS
# LONGER DIE LIFE

## When You Use Magnus Dri-Draw Compounds in your dry-drawing operations

Designed for high speed production with unique ability to follow the metal through the die, even in the hardest of draws, Magnus Dri-Draw Compounds offer you material improvements in production along with worthwhile reductions in die replacements.

*Magnus Dri-Draw* #1—a granular, "bone-dry" soda base drawing lubricant for general use on low carbon wire.

*Magnus Dri-Draw* #4—A granular, completely anhydrous calcium base lubricant for both low and high carbon wire drawing. It is also used on stainless and other alloy wire. It provides a film of great tenacity and adhesion . . . is highly resistant to heat . . . and provides good lubrication even at high speeds where other compounds fail.

*Magnus Dri-Draw* #6—an anhydrous calcium base lubricant containing integrally free lime. It is used on high speed drawing of low, and, in particular, high carbon wire. This lubricant is especially suited for drawing in conjunction with Magnus Metalcoat #267.

Magnus Dri-Draw Compounds have proved their superiority in the draw. That is why production managers, in mill after mill, have consistently selected Magnus Dri-Draw Compounds.

*We will be very glad to supply working samples for plant-scale tests.*

**MAGNUS CHEMICAL COMPANY, INC.**
**188 South Avenue, Garwood, N. J.**
*Service representatives in principal cities*

**Magnus**

**CLEANERS • EQUIPMENT • METHODS**

# Wire drawing machines

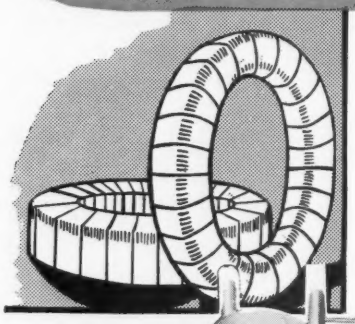
"Always reliable!"... was the operator's remark about this wire-drawing machine which has continuously produced steel-wire for our customer every single working-day for 12 years.

We manufacture drawing machines for drawing wire from rod max. ¾" down to 0.005" diameter of any ordinary material — ferrous and non-ferrous metals — and fitted with one or several blocks. May we have your inquiry?

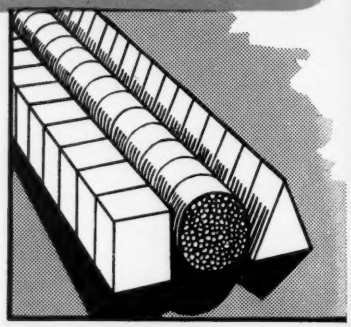
**MORGÅRDSHAMMAR**

MORGÅRDSHAMMARS MEK. VERKSTADS AB · MORGÅRDSHAMMAR · SWEDEN

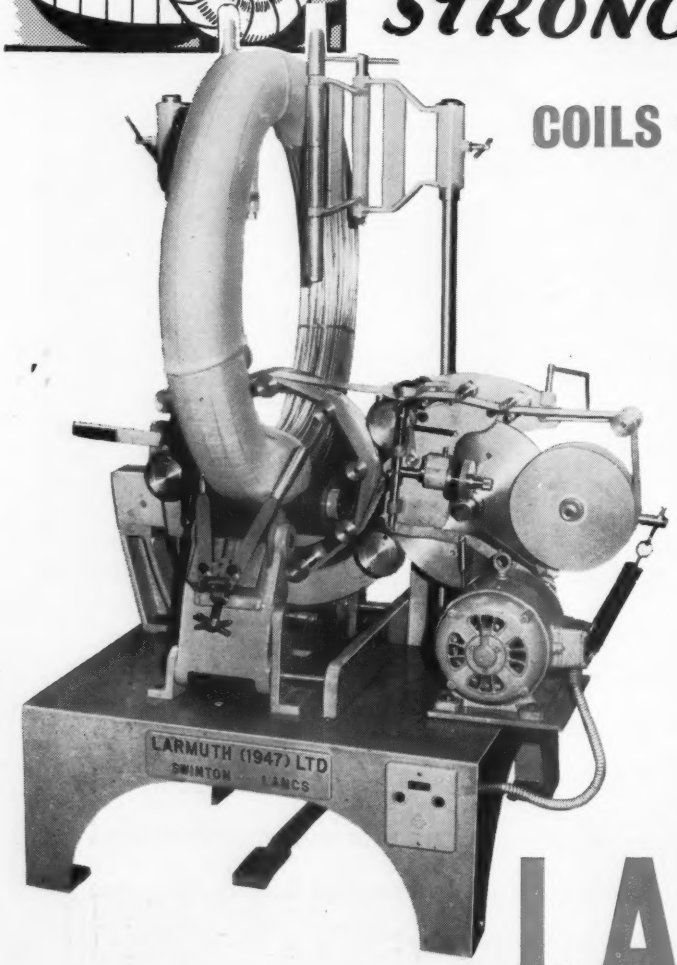
# It Wraps These



## QUICKLY NEATLY STRONGLY



## COILS • WIRE • BARS • TUBES




For wrapping coils of Wire, Cable, Steel Strip, Tires or similar products in Kraft, Crepe and Waterproof papers, Cellulose Films or Hessian, etc. Also suitable for wrapping bundles of Bars, Rounds, Tubes, Sections, etc. Two Standard models wrap coils 8″ to 24″ outside diameter, up to max. width of 5″ and coils 12″ to 36″ outside diameter, up to max. width of 8″.

Manufactured by Messrs. Larmuth, Ltd., East Lancashire Road, Swinton, Manchester, England.

# LARMUTH

## POWER WRAPPING MACHINES

**MARSHALL RICHARDS MACHINE COMPANY, INC.**

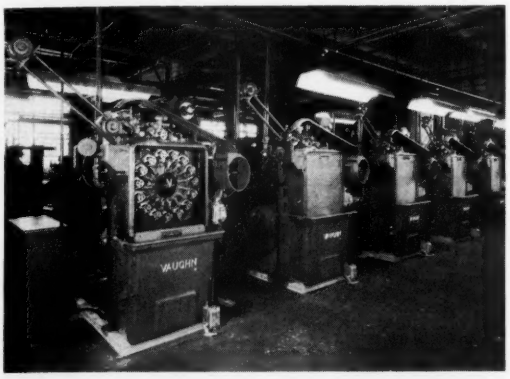
1100 SOUTH BROAD STREET
TELEPHONE: TRENTON 9478

•

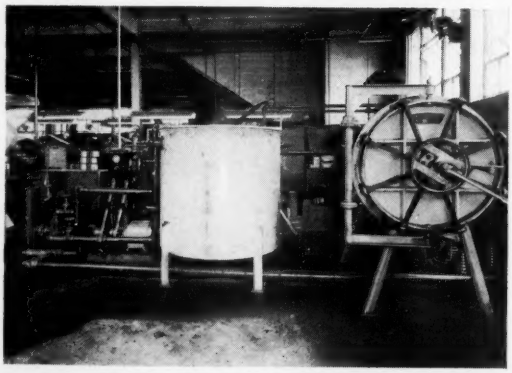
TRENTON 10, NEW JERSEY
TELEGRAMS: MARICH · TRENTON

# SAVES $1,150.00 a month by installing...

# HERCULES PRESSURE LEAF FILTERS



*View of Vaughn wire drawing machines in this fine plant, served by a single Hercules Pressure Leaf Filter.*



*This filter serves the plant's big Vaughn wire drawing machines.*

An important wire drawing and strip rolling plant operates a battery of twelve 16 CF-1, six 16 CF-2, and four 12 HF Vaughn wire drawing machines. The company draws stainless steel, nickel, chrome, and other high alloy wires, at speeds approximately 1000 to 1500 feet per minute.

One Hercules Pressure Leaf Filter assures pure oil for lubrication and cooling for all these wire drawing machines.

By substituting for the soluble oil a light mineral oil, and continuously removing particles and dirt with a Hercules Pressure Leaf Filter many advantages resulted. Cooling effect is high. Die life is extended. Rust is eliminated. Machines are not stopped because filtration is continuous.

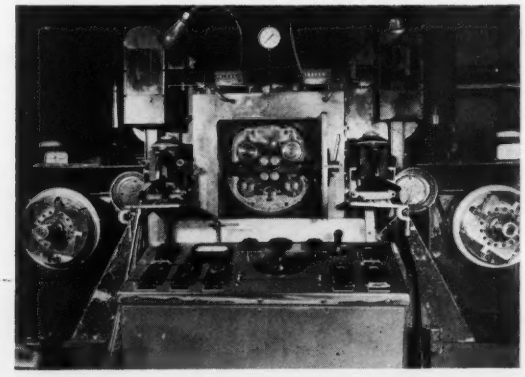
In two years only one batch of oil has been used. Only once in that period has it been necessary to add any additive material.

The savings in oil alone amount, at a conservative estimate, to $1,000 a month.

A second Hercules Pressure Leaf Filter serves the plant's fine Sendzimir strip rolling mill with a saving of $150 a month.

Based on previous unsatisfactory experience with costly oils and faulty lubrication and cooling, the monthly savings effected amount to $1,150.00 per month, not including previous costs of replacing damaged dies and parts due to impure lubrication and cooling oil.

Write for four-page, two-color folder which gives full details of this installation and the savings and other values effected through the use of Hercules Pressure Leaf Filters. Send for your copy today. No obligation implied.



*This Sendzimir Strip Rolling Mill gets a continuous spray of lubricating oil filtered by the Hercules system.*

**HERCULES Filter Corporation**

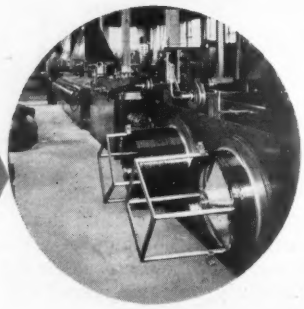
**Main Office, Laboratories, and Plant • 204-P 21st Avenue • Paterson, N. J.**

# THE *Trauwood* PROCESS IS SETTING A NEW "WIREBOUND" TRADITION!!

QUALITY, UNIFORMITY, LOW-COST OPERATION

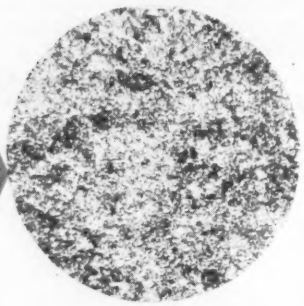
★ The electric resistance heating used in our process is over 90% efficient and results in a uniformly heat treated product plus the ability to duplicate exact heating and quenching cycles from day to day. Positive circulation in the molten metal quench bath insures absolute uniformity of the wire.

FASTER PRODUCTION FULLY AUTOMATIC



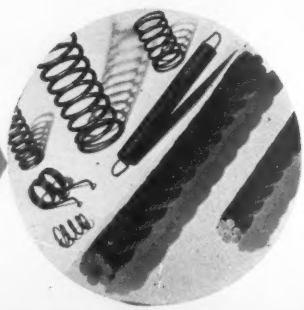
★ The TRAUWOOD process is much faster than ordinary furnace heating due to the very rapid rate of electric resistance heating. The equipment is entirely automatic and is easy to operate. Greater production with a material reduction in pickling and cleaning costs is insured.

BROAD THERMAL RANGE ACCURATE CONTROL



★ The finer grain produced by TRAUWOOD electric resistance heating develops the maximum physical and fatigue properties in any steel in either patenting, tempering or annealing. The annealing of stainless steel and other alloy wire and strip is readily accomplished since the high quenching temperatures necessary are easily and rapidly attained.

CAN BE DESIGNED FOR ALL SIZES AND TONNAGES



★ The TRAUWOOD process, in addition to doing a better wire heat treating job, is opening new fields of application for the wire industry. The equipment is designed to meet your specific requirements and can be built to handle all sizes in any tonnage required. Full information will be furnished on request.

*Patented in U.S.A. and Foreign Countries*

## THE TRAUWOOD ENGINEERING COMPANY

15200 BROOKPARK ROAD • BOX 2719 WESTPARK STATION • CLEVELAND, OHIO

JOHN RIGBY & SONS, LTD., LOW MOOR, BRADFORD-YORKS, ENGLAND — BRITISH REPRESENTATIVE

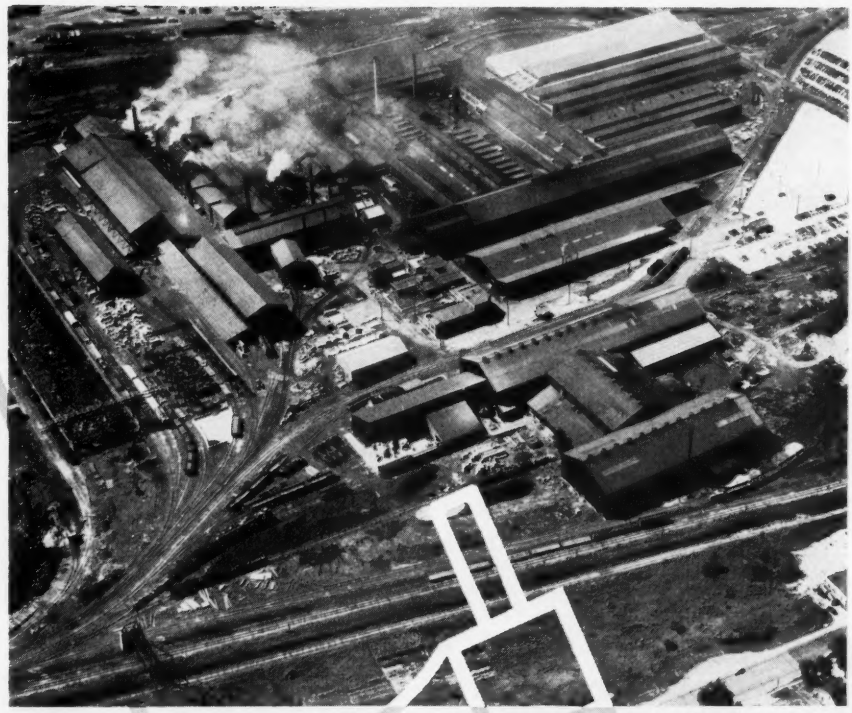
DR. ING., H. HOHLE, LOHNE UBER SOEST, WESTFALEN, GERMANY — GERMAN REPRESENTATIVE

# LACLEDE Quality Control

## from Start to Finish

## Means a Better Wire Product for You

Oil Tempered
High Carbon Spring
Stapling
Fine and Weaving
Rope
Low Carbon Bright Basic
Bookbinding
Tinned,
Copper Coated
Liquor Finishes
Galvanized



*The Laclede*
*Alton, Illinois, Works.*

From the open hearth to the finished wire . . . Laclede wire is made to your specifications . . . with every step in the manufacture carefully controlled . . . assuring uniform temper, gauge and finish.

Let Laclede engineers and metallurgists aid you in developing wire specifications on these—and many other Laclede quality wires.

®LACLEDE

*Producers of Steel for Industry and Construction*

**LACLEDE STEEL COMPANY**

*St. Louis, Mo.*

# For the FINEST Dies...

*Specify*

*DIES... TOOLS... WEAR PARTS... BLANKS...*

# The Wire Outlook

Traditionally, October has been the month in which The Wire Association has met for its annual Convention. To avoid conflict with the meetings of other societies, which some of our members have expressed a desire to attend, the time for our wire assemblage has been moved to November.

This has some advantages besides the mere matter of convenience, among which is that Wire and Wire Products, with its pre-printed technical papers and program, will be in the hands of all its readers long enough in advance to give them an opportunity to study the papers and be prepared with comments and questions on them.

Advance reservations for the Convention are running high, with a large attendance indicated. This is a matter of great satisfaction to the officers and directors of The Wire Association, who are looking forward to meeting and greeting the many who will be convening next month.

With the major steel strikes settled and production back on a routine, even though high capacity basis, our conventioners can come to Cleveland freed of the worries and headaches of the summer months.

While the steel mills are doing all they can to satisfy customers, the demands upon them are heavy and will continue so at least through next spring. Ingots and steel for castings are now flowing from the mills in excess of 2,000,000 tons a week. Aluminum and copper have improved in availability under existing controls and are now in sufficient supply to meet allocations. Most previously prohibited uses for copper are now permitted and allotment percentages have been increased. Zinc appears to be abundant again, with orders being filled promptly.

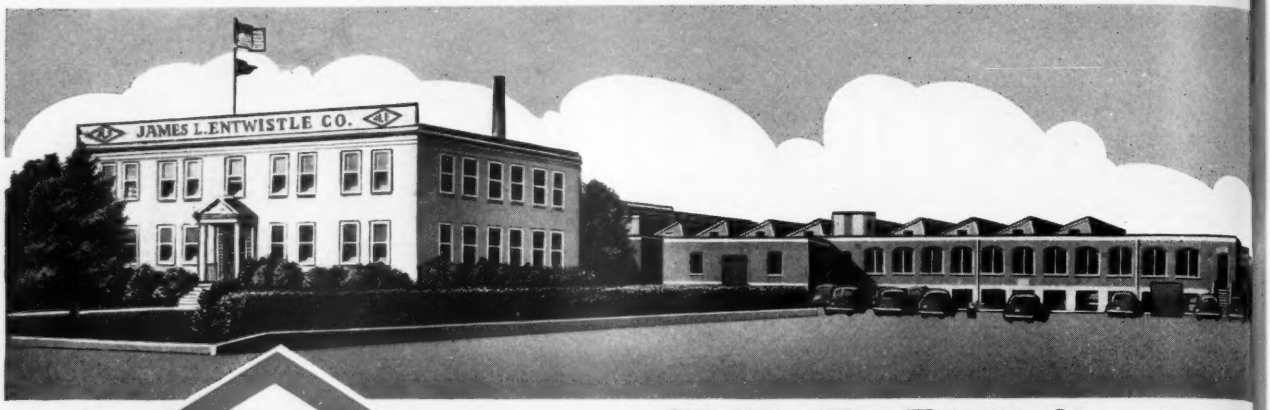
Price controls are expected to be off most consumer goods by November, exceptions being food, autos and large home appliances. The removal of controls, however, is not expected to result in price increases, as competition has kept most of them under authorized ceilings. Basic materials, machinery and chemicals bought by industry will continue under controls. Business in general has been experiencing its fall pick-up, which is expected to continue through the next six months at least. Factors contributing to this are rising consumer income, defense expenditures, deficit spending, and a rate of building construction running close to peak.

A new technological revolution is under way, the result of research, that should bring new products, processes, machinery and equipment. Those industrialists who have expanded their plants should be able to keep them busy in the coming years due to the high rate of population growth. In the next two decades, the Census Bureau estimates, there will be an increase of approximately 40 millions of people.

The demand for wire specialties and manufacturers' wire is running high because of inventory depletions and finished wire products are moving to consumers in good volume. By next month most mills' schedules should become current. The automotive industry is again buying and the demand for oil tempered wire—as well as other types used by the industry—has approached normal. Bolt and nut inventories will be low until the steel wire for them becomes in better supply. Bolts and nuts in sizes in excess of ½ inch are particularly short.

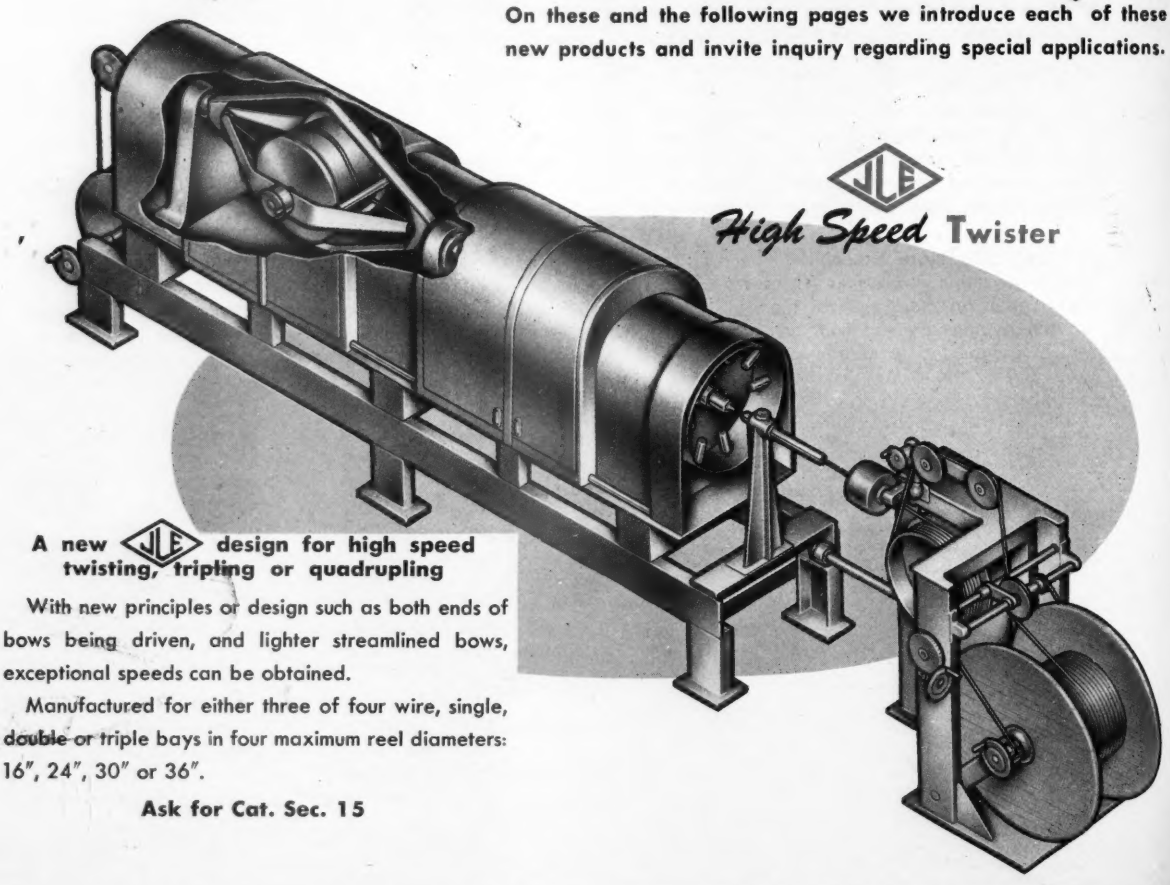
The major question before our nation will be answered in November, when the country's collective wisdom will be expressed. On a proper understanding of the basic principles involved in the political campaign and its corresponding expression at the polls, will depend the future course of our country and perhaps of freedom throughout the world. The incumbent party can not maintain that freedom.

—from the Editor's Desk




# JAMES L. E

Since our expansion we have been able to develop several new products to supplement the established JLE line. On these and the following pages we introduce each of these new products and invite inquiry regarding special applications.



## JLE *High Speed* Twister

**A new JLE design for high speed twisting, tripling or quadrupling**

With new principles or design such as both ends of bows being driven, and lighter streamlined bows, exceptional speeds can be obtained.

Manufactured for either three of four wire, single, double or triple bays in four maximum reel diameters: 16", 24", 30" or 36".

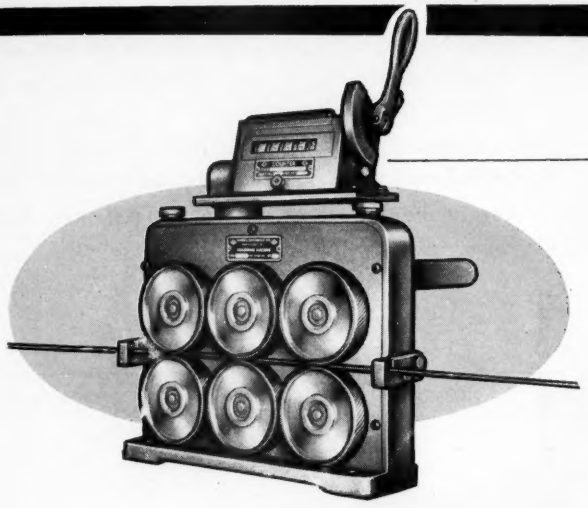
**Ask for Cat. Sec. 15**

*Leading Designers and Builders of*

# INTRODUCING *NEW* EQUIPMENT

## ADDED TO THE JLE LINE

# ENTWISTLE CO.

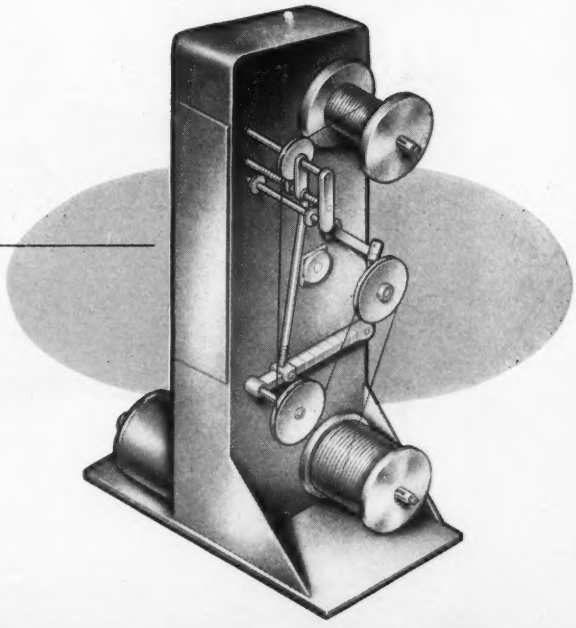


### Measuring Machine Class S

**A six-wheel measuring machine for steel or other bare wire**

The use of six wheels geared to the counter with a minimum of friction permits the highest possible accuracy of any measuring machine. Will handle solid bare wire to a maximum diameter of ⅛".

**Ask for Cat. Sec. 11H**



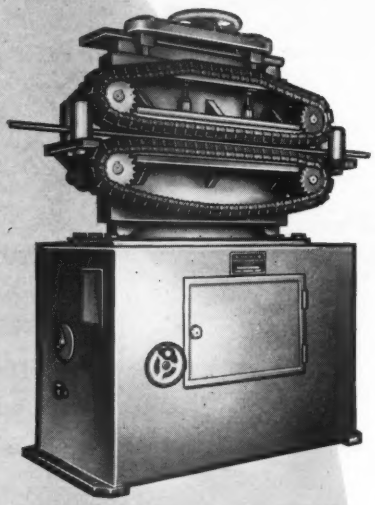
### *High Speed* Magnet Wire Re-Spooler

This JLE designed re-spooler incorporates a differential drive giving constant tension and constant wire speed for accurate spooling of bare or insulated magnet or similar wires. The spools may be up to 12" maximum diameter and have a maximum weight of 100 lbs.

**Ask for Cat. Sec. 3F**

**WIRE MACHINERY *for over* 30 YEARS**

# JAMES L. ENTWISTLE CO.



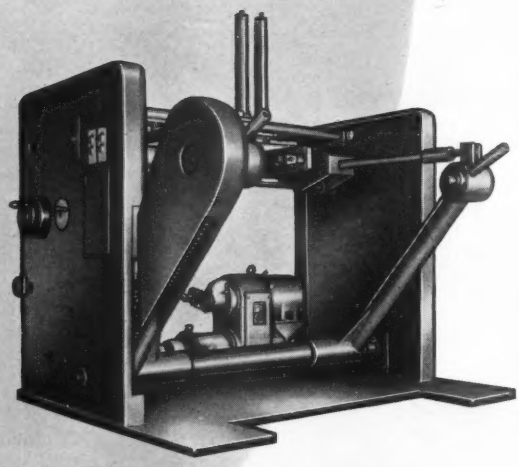
## "Caterpuller"

**An improved method of pulling cable**

The "Caterpuller" is an improved method of pulling cable through machines such as stranders, cables, etc. Capstan wheels are eliminated by using the caterpillar principle. Horizontal pull is imparted to the wire as it passes between two belts which consist of series of synthetic rubber gripping treads.

"Caterpullers" are now being built in two sizes: Class "A" to handle up to 2¾" O.D. and Class "C" up to 6" O.D.

**For further information ask for Cat. Sec. 16A**



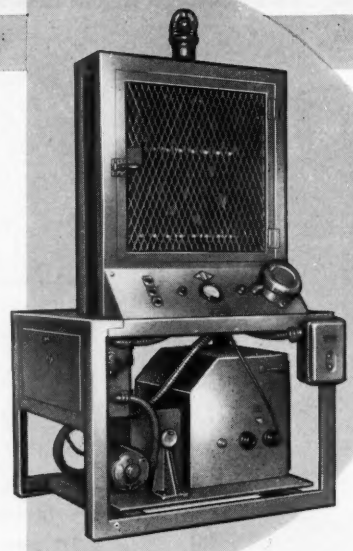
## *Shaftless* Take-Up and Pay-Off

On the JLE shaftless take-ups and pay-offs accommodations for both the reel diameter and width are easily adjustable by an indicating controller. The reel-shaft speed can be changed without stopping the entire unit. Reels of 48" to 84" diameter are handled by this machine with stress limits engineered for reels up to 8 tons. Heavier units are contemplated.

**Ask for Cat. Secs. 3E and 13H**

*All JLE Equipment is Engineered for* **DURABILITY**

# *NEW* EQUIPMENT ADDED TO THE JLE LINE

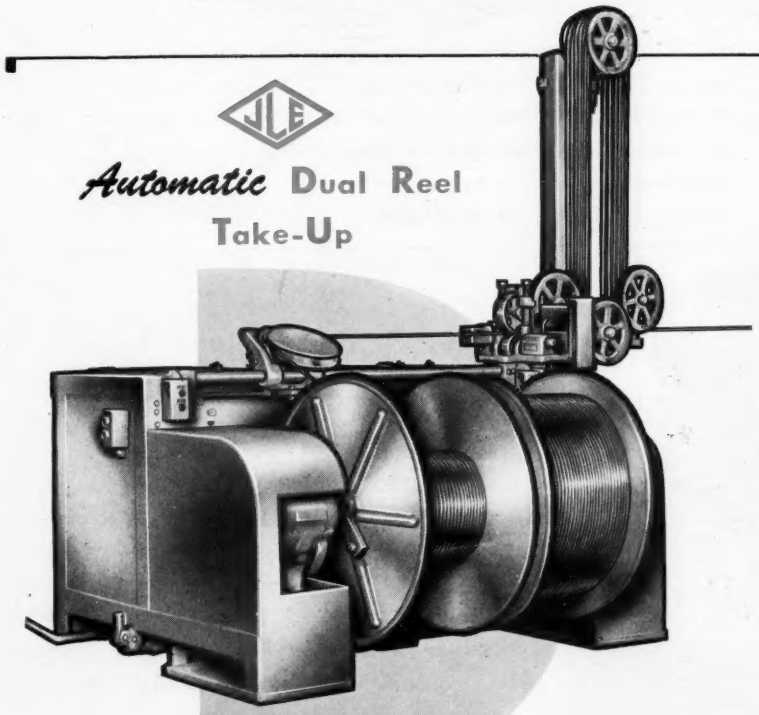


## Ignition Harness Lead Tester Class A

A completely automatic machine for testing ignition harness leads. Test voltage automatically increases from zero to pre-set test voltage.

A.C. voltage ranges up to 30,000 maximum volts R.M.S. D.C. ranges up to 40,000 volts.

**Ask for Cat. Sec. 21H**



## *Automatic* Dual Reel Take-Up

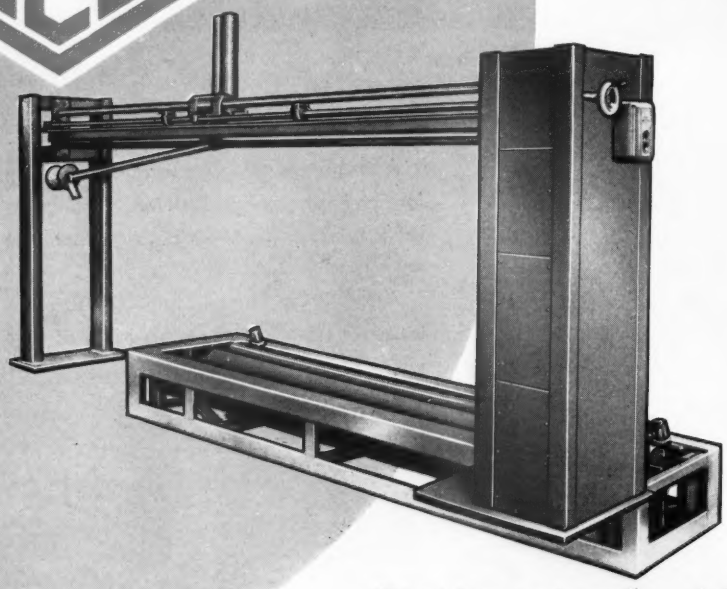
**A fully automatic take-up**

The first completely automatic take-up in the wire industry for extruders or continuous vulcanizing machines. The functions of wire tension, lay and traverse width are easily adjustable. Reels are power lifted in and out of position.

**Ask for Cat. Sec. 3C**

# JAMES L. ENTWISTLE CO.

# JAMES L. ENTWISTLE CO.



## *Floor-Roller* Take-Up and Pay-Off Stands

**Ask for Cat. Secs. 3D and 13G**

These take-ups and pay-offs are designed to handle reels up to 120″ outside diameter and up to 132″ wide. The traverse is infinitely variable and will handle cable up to 4″ maximum O.D. Speed control is automatic. Power lift will raise and lower reels up to a maximum of 50 tons. Built in 3 types: 16, 25, and 50 ton capacity.

## Differential *Speed* Unit

**A complete unit, including motor**

A zero R.P.M. shaft speed can be obtained by handwheel control. Speed can be increased with either direction of rotation. Driven by a 2 H.P. motor.

**Ask for Cat. Sec. 21G**

*Designed and Built by Men Who Know Wire*

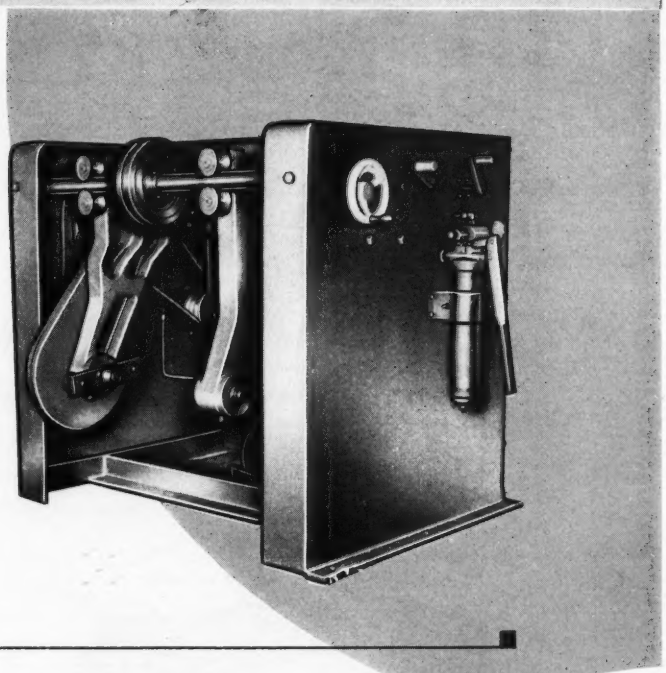
# NEW EQUIPMENT ADDED TO THE JLE LINE

## Traversing-Reel *Shaftless* Take-Up

**A take-up for rectangular wire**

This JLE designed shaftless take-up is for winding rectangular wire in which the reel is traversed to avoid edgewise bending of the wire. This produces more accurate spooling. Manufactured in many sizes.

**Ask for Cat. Sec. 3E**



## *Multiple* Wire Heads for Extruders

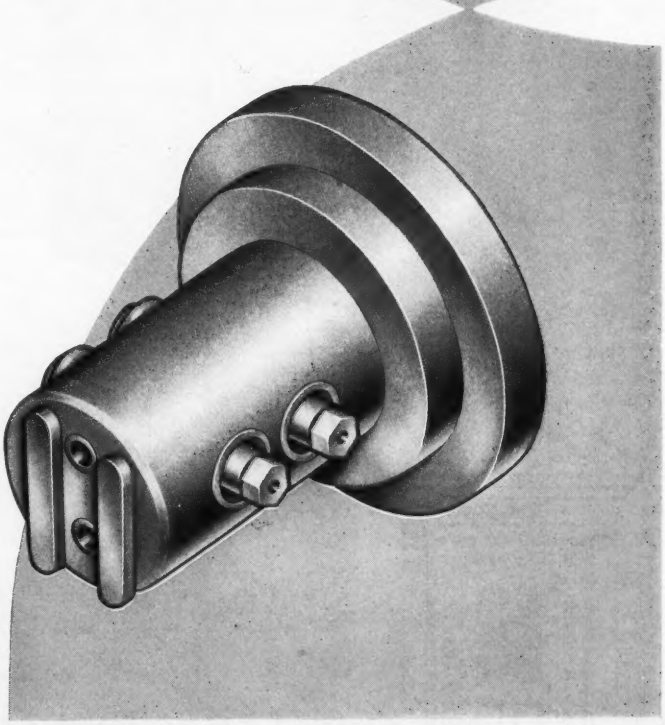
## Two, Three, or Four Wire

Replace your "horse and buggy" extrusion head with a JLE two, three or four wire head. These multiple extrusion heads may be adapted to your present extruder with little or, in most cases, no modifications.

An interesting and useful feature of these heads is that the compound flow to each tool set may be regulated or turned off individually This allows servicing, changing strand, or tip and die replacement on any one tool set while the remainder continue operating.

Of course, the outstanding feature is the highly increased production.

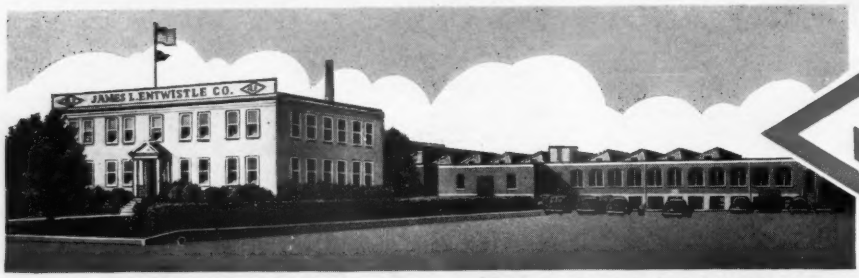
**Ask for Cat. Sec. 9A**



JLE

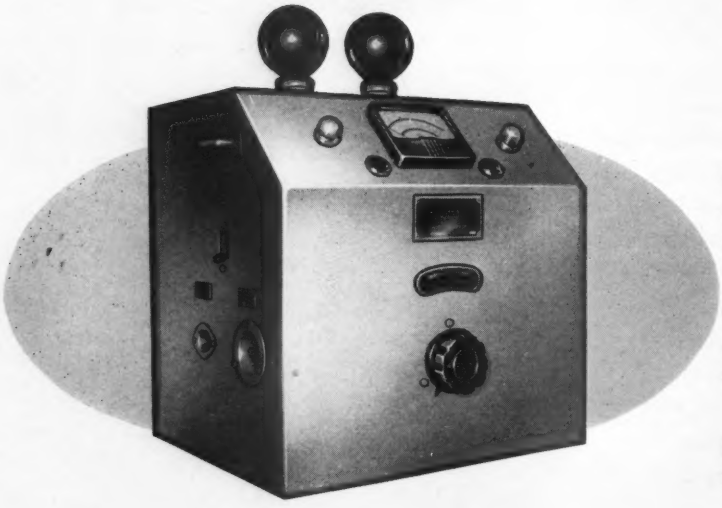
JAMES L. ENTWISTLE CO.

# *NEW* EQUIPMENT ADDED TO THE JLE LINE




# JAMES L. ENTWISTLE CO.

These new products, introduced on this and the preceding six pages, have been developed to supplement the established JLE line. Our recent expansion combined with over 30 years experience as leading designers and builders of wire machinery have made these new products possible.



## Wire Sparker Class D

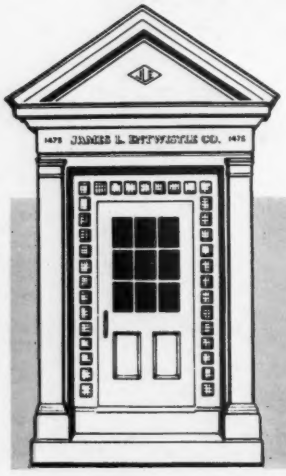
A new line of direct-current sparkers from 2000 to 160,000 volts maximum. Permits easier sensitivity control for testing materials with high leakage.

High speed sensitivity locates flaws in continuously moving wire or cable with positive control of take-up equipment (1/1000 second response).

May also be used to furnish D.C. for long period test in finished cable under water or in lead.

**Ask for Cat. Sec. 8D**

We invite inquiry regarding any special application of these products. As in the past JLE will be only too happy to cooperate in solving problems in the wire machinery field.




## JAMES L. ENTWISTLE CO.

**1475 ELMWOOD AVENUE**

**PROVIDENCE 7, RHODE ISLAND**

*European & South American Agents:*
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*British Associate:*
**GENERAL ENGINEERING CO., LTD.**
**BURY ROAD, RADCLIFFE, LANCS., ENGLAND**

WIRE
AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

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# SIGNIFICANCE OF THE ELONGATION TEST ON WIRE

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**In this paper, presented at the Convention of the Wire Association on November 11, 1952, in Cleveland, Ohio, the author describes the results of tests that may be used as a measure of ductility.**

**Mr. Godfrey was born in Needham, Mass., and graduated from Tufts College in 1931 with a B.S. in Civil Engineering. He held a Research Fellowship at Lehigh University from 1931 thru 1933 and graduated with an M.S. in Civil Engineering. From 1934-1937 he was a Research Engineer for the John A. Roebling's Sons Company. From 1937 to 1941 he was Engineer of Tests at the Fritz Engineering Laboratory at Lehigh University. He rejoined Roebling in 1941 as a Development Engineer.**

Howard J. Godfrey * * * *

## Introduction

**The** tensile test has been the principal method of determining the physical characteristics of metals during the long history of materials testing. As a part of the tensile test the measurement of the elongation in a specified gage length has been used as an index of ductility. Bonzel* has indicated however that the most ductile wires are not always those which have the greatest elongation.

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**The** wire industry in general has realized the limitations of the elongation test as a measure of ductility and has substituted other types of mechanical tests such as the torsion, wrap and bend tests. There are specifications in effect today which require elongation tests on wire and in some instances the specifications are very difficult or impossible to meet. It is suggested that the ductility of wire could be evaluated more accurately by other test methods.

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**The** end use of the material should be considered very carefully by specification writers before the requirements of a given product are specified. If possible, only those tests which most accurately represent the end use of a material should be included in the specifications.

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**It is** often impossible to specify a test which will adequately represent the end use of a material and the required tests are specified to indicate that the material is similar to that previously used and which has proven to be satisfactory.

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**It is** also realized that the elongation test can be used to control manufacturing processes and for this purpose it is of value.

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**The** purpose of this paper is to indicate what factors affect the elongation test and to demonstrate how the deformation which takes place in the tensile test can be used as a reliable measure of ductility. This paper is concerned with hard drawn wire in the as-drawn condition and after various treatments.

## The Elongation Measurement

**The** elongation of a tensile specimen is generally measured by the following methods:

**1. Total Elongation: The total elongation is measured by means of an extensometer attached to the test specimen. This method of testing measures both the elastic and plastic deformation between zero load and the fracture load.**

**2. Residual Elongation: The residual elongation is determined by placing gage**

*"Steel Wire" by Maurice Bonzel, 1935, p. 210. Engineers Book Shop.

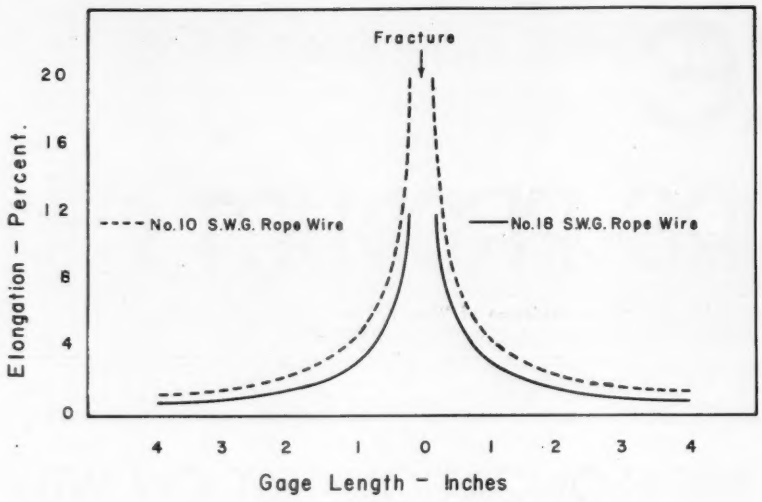


Fig. 1 Effect of Gage Length and Diameter on the Percentage Elongation of Hard Drawn Rope Wire.

**marks on the test specimen prior to testing. After the specimen has been tested to failure the two pieces are fitted together and the increase in gage length is measured. This method of testing measures only the plastic or permanent deformation of the material.**

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**For** both the above methods the elongation value is reported as a percentage of the original gage length.

## Effect of Gage Length and Diameter

**Probably** the major factor which limits the usefulness of the above elongation measurements is the distribution of the elongation over the gage length. If a wire is stretched uniformly along its gage length throughout the complete tensile test, the percentage elongation value would be a useful index. We find, however, that in the vicinity of the fracture, the elongation is many times that a short distance from the fracture. This condition is not peculiar to hard drawn wire but is found in the testing of all other wrought metallic materials.

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**The** distribution of the elongation has been illustrated very effectively by Adam* and is reproduced in part in Fig. 1.

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**Additional** test results on the effect of gage length on elongation are presented in Fig. 2. Nine different wire sizes were tested ranging from .061 inches in diameter to .283 inches in diameter and the results indicate

*"Wire Drawing and The Cold Working of Steel" by A. T. Adam, p. 89, 1936, H. F and G. Witherby.

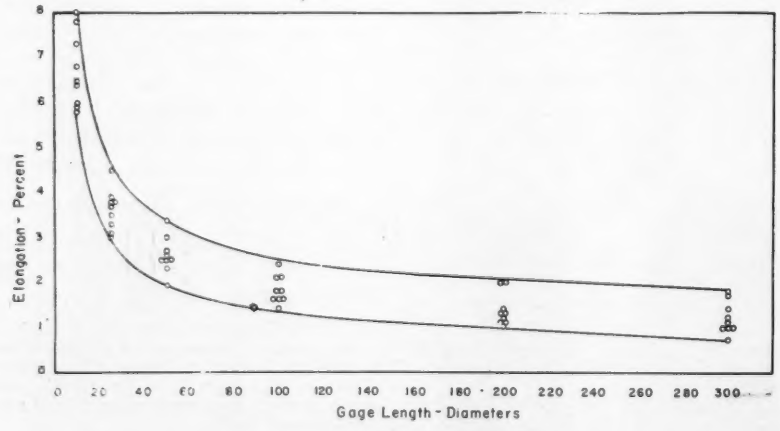


Fig 2 Effect of Gage Length on the Percentage Elongation of Hard Drawn Wire.

that the gage length has a marked influence on the residual elongation of hard drawn wire, particularly when the gage length is less than 100 diameters. The variation in the percentage elongation values at any given gage length, e.g. at 100 diameters, is due to variations in the manufacturing practices used for the different wire sizes.

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**Fig. 1 and Fig. 2** illustrate why a larger diameter wire having substantially the same manufacturing practice as another wire will more readily meet a specified percentage elongation in a 10 inch gage length.

## Relation Between Load and Elongation

**In the** general mill test the maximum load and the total or residual elongation are recorded. The relationship between the load at any time and the corresponding percentage total elongation is not observed. An illustration of this relationship is shown in Fig. 3.

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**During** the initial stages of the tensile test the load increases rapidly with relatively little elongation. As the load approaches a maximum, the rate of elongation increases and at the maximum load the curve becomes horizontal. Up to this point the elongation has been uniform ($e_u$) over the entire gage length.

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**From** the point of maximum load to the actual fracture load, all of the elongation ($e_n$) takes place in one localized section commonly known as the "neck". There is no particular physical meaning to the stress at which the uniform elongation stops and the necking elongation starts. It is only that place where the increase in load carrying capacity due to strain hardening has been equalized by the decrease in area.

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**As the** load decreases after necking begins, the stress on the uniform section of the specimen actually decreases. The stress on the minimum or necked section, however, increases and fracture finally takes place when the true ultimate tensile strength of the material is reached. Due to the complex stress condition

in the necked section the tensile fracture is initiated on the axis of the specimen. This initial fracture is a cohesive or normal failure which is followed by a shear failure near the surface of the specimen. These two distinct types of failure result in the familiar cup-cone fracture associated with a tensile test on ductile steels.

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**The** test illustrated in Fig. 3 shows that the total percentage elongation was only 3.8% in a 10 inch gage length. It is probable that 95% of the gage length stretched 3.0% and the remaining 5% of the gage length stretched many times this amount.

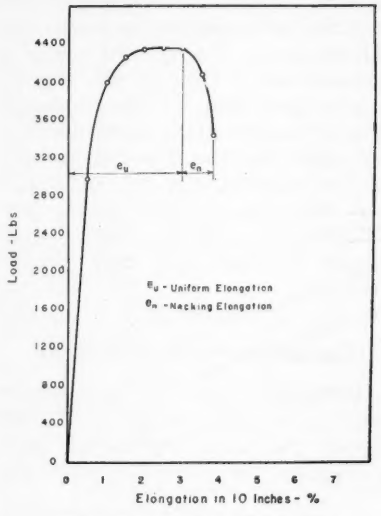


Fig 3 Tensile Test on .177 in. Diameter Hard Drawn Wire
Load—Percentage Elongation in 10 inches

It is therefore illogical to assume that the total percentage elongation will have any significance on how much a material will stretch locally before fracturing.

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**From** a ductility point of view we are generally interested in whether a wire can be bent, twisted or deformed locally in some manner without fracturing. To illustrate how much elongation is required for deforming let us consider the following example:

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**A piece** of the hard drawn .177" diameter wire, as shown in Fig. 3, can be wrapped around a mandrel 1.6 inches in diameter without failure. This mandrel is nine times the wire diameter and in making this test the outer layers of the wire are stretched approximately 10%. The value of 3.8% total elongation as determined in the usual tensile test has therefore apparently no significance.

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**A bend** or wrap test over a mandrel nine times the wire diameter is not considered a drastic test but does illustrate that for severe bends much more than 10% elongation is required. For example, when a wire is bent over its own diameter the outer layers are stretched 50% elongation. The particular piece of hard drawn wire in Fig. 3 can be wrapped around its own diameter without fracture and illustrates again that the average elongation in a 10 inch gage length is of no real value for indicating the true ductility of hard drawn wire.

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**The** question is raised, therefore, as to what values measured in the tension test have any significance as to the ductility of materials under severe deformation.

## Relation Between Load and Elongation at the Neck

**We have** previously shown that the elongation in the neck of the tensile specimen is considerably greater than that in the uniform section. If we assumed that the entire gage length stretched to the same extent as the neck, the magnitude of this deformation would be readily appreciated.

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**The** elongation at the neck can be calculated from diameter measurements observed during the tensile test.

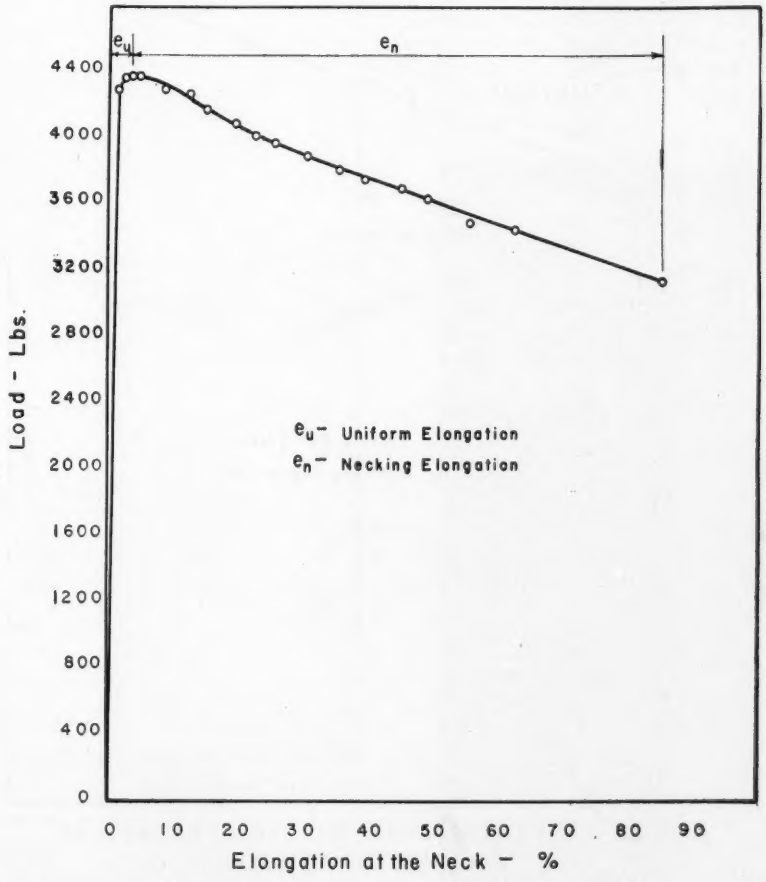


Fig. 4 Tensile Test on .177 in. Diameter Hard Drawn Wire.
Load—Percentage Elongation at the Neck.

$$\% \text{ Elongation} = \left[\frac{L_1 - L_0}{L_0}\right] \times 100$$

where $L_0$ = original gage length
$L_1$ = final gage length

Since the volume does not change

$$\% \text{ Elongation} = \left[\frac{A_0 - A_1}{A_1}\right] \times 100$$

$$\text{or } \left[\frac{A_0}{A_1} - 1\right] \times 100$$

where $A_0$ = original area
$A_1$ = final area

$$\text{or } \left[\frac{d_0^2}{d_1^2} - 1\right] \times 100$$

where $d_0$ = original diameter
$d_1$ = final diameter

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**The** relation between tensile load and the percentage elongation at the neck is shown in Fig. 4. This graph presents an entirely different picture from that of Fig. 3 and illustrates much more accurately the amount of deformation which takes place in the tensile test. The uniform elongation is very small compared to the elongation at the neck and the magnitude of the elongation at the neck offers an explanation as to why this material can be wrapped on its own diameter without fracture.

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## Relation Between Stress and Elongation at the Neck

**We have** previously been relating the various elongation measurements to the load in pounds. If we had related the elongation to the nominal tensile stress, load divided by the original area, these relationships would not change. However, if we calculate the true stress on the tensile specimen and relate it to the corresponding elongation, we have a different result. The true stress is computed by dividing the load by the minimum area at that load. During the necking stage the minimum area will be at the necked section. The relationship between true stress and the elongation at the neck is illustrated in Fig. 5. For comparison a curve relating the nominal tensile stress to the elongation at the neck is also presented.

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**The** two curves up to the start of necking are quite similar. However, from this point on the true stress-elongation curve continues to rise. The true stress on the necked section therefore increases throughout the test and the slope of the curve during the necking stage is determined in part by the rate of strain hardening of the material. Fracture takes place when the true stress reaches the cohesive strength of the material. For this particular test the true fracture stress was 246,000 p.s.i. whereas the nominal tensile strength was only 178,000 p.s.i.

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## Comparison of Test Methods

**Using** two types of hard drawn wire, a comparison was made between the usual percentage total elongation measurement with the

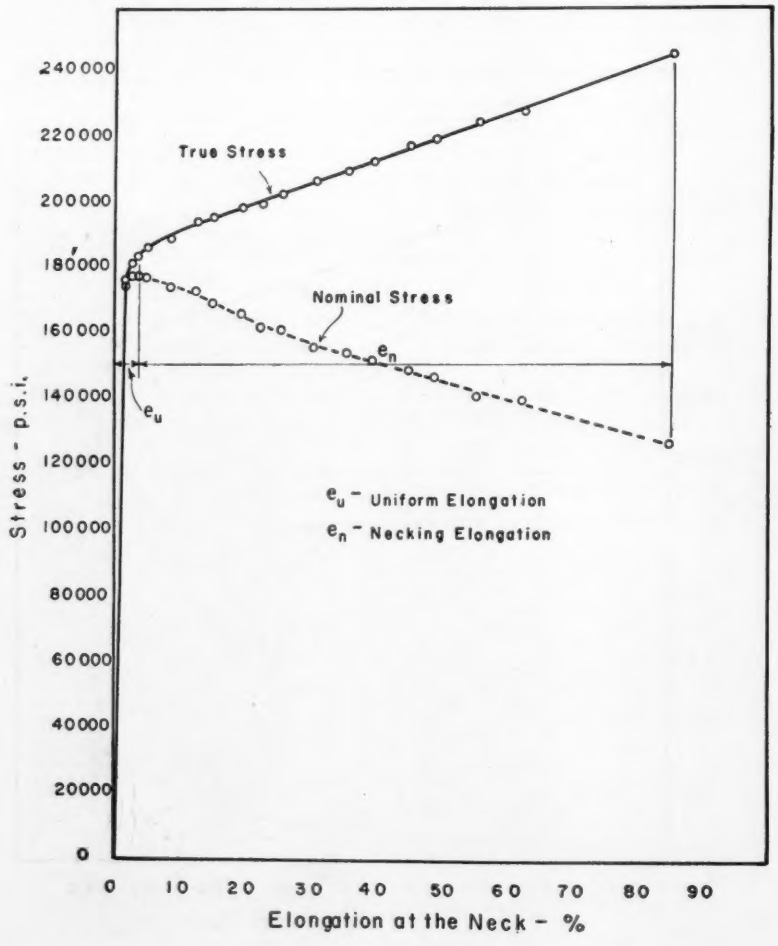


Fig. 5 Tensile Test on .177 in. Diameter Hard Drawn Wire
True Stress — Percentage Elongation at the Neck.

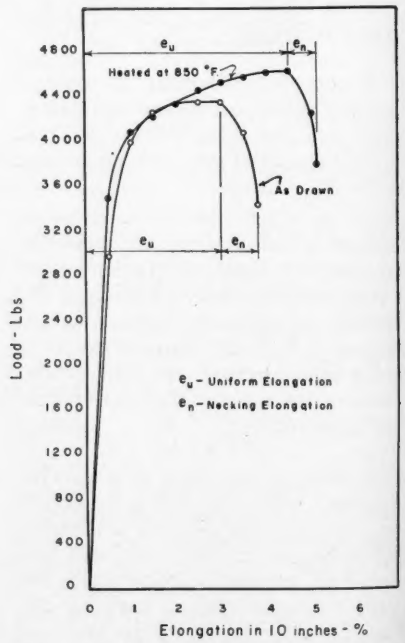


Fig 6 Tensile Test on .177 in. Diameter Hard Drawn Wire
As Drawn and Heated at 850 °F.
Load — Percentage Elongation in 10 Inches.

elongation at the neck to determine the usefulness of each as a ductility index.

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**Tests** were made on the .177″ diameter hard drawn wire in the following two conditions:

**1—As Drawn**
**2—After heating to 850°F for 30 seconds**

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**The** two tests are illustrated in Fig. 6 and Fig. 7 and show that according to the usual elongation measurement the heated wire had the greater ductility. However, on the basis of necking elongation, as shown in Fig. 7, the wire as-drawn had the greater ductility. The results of these tests are compared with other methods of testing in Table I.

**TABLE I**

**Properties of .177″ Diameter Hard Drawn Wire**

| | | As-Drawn | After Heating to 850°F for 30 Seconds |
|---|---|---|---|
| Tensile Break | lbs. | 4,390 | 4,640 |
| Ultimate Tensile Strength | p.s.i. | 178,000 | 188,000 |
| Total Elongation in 10″ | % | 3.8 | 5.3 |
| Total Elongation at the Neck | % | 85.0 | 56.0 |
| Reduction of Area | % | 46.0 | 36.0 |
| Torsions in 100 Diameters | | 22 | 10 |
| Bends on 10X Mandrel | | 26 | 20 |
| Ring Strength | lbs. | 4650<br>4600<br>4680 | 2000<br>600<br>2900 |
| Wrap Test on Own Diameter | | OK | OK |

**All** of the above tests are quite familiar with the exception of the ring test, which is made by pulling two 12 inch diameter interlocking rings to failure. The rings are first preformed and then welded to form a solid ring. The two rings are then pulled in a tension machine making sure that the welds do not affect the test. The wires fail where the two rings are in contact with each other and the breaking load is recorded. The results of three tests show the uniformity of the as-drawn wire and low ring strength of the heated wire.

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**All** of the test results in Table I indicate a loss in ductility after heating with the exception of the percentage elongation test in 10 inches.

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**A photograph** showing the type fractures obtained on the ring test specimens is presented in Fig. 8. The as-drawn wire (No. 1) fractured at a 4650 pound load and considerable necking took place at the point of contact of the two rings. The heated wire (No. 2) fractured at only 600 pounds and showed no visible indication of necking.

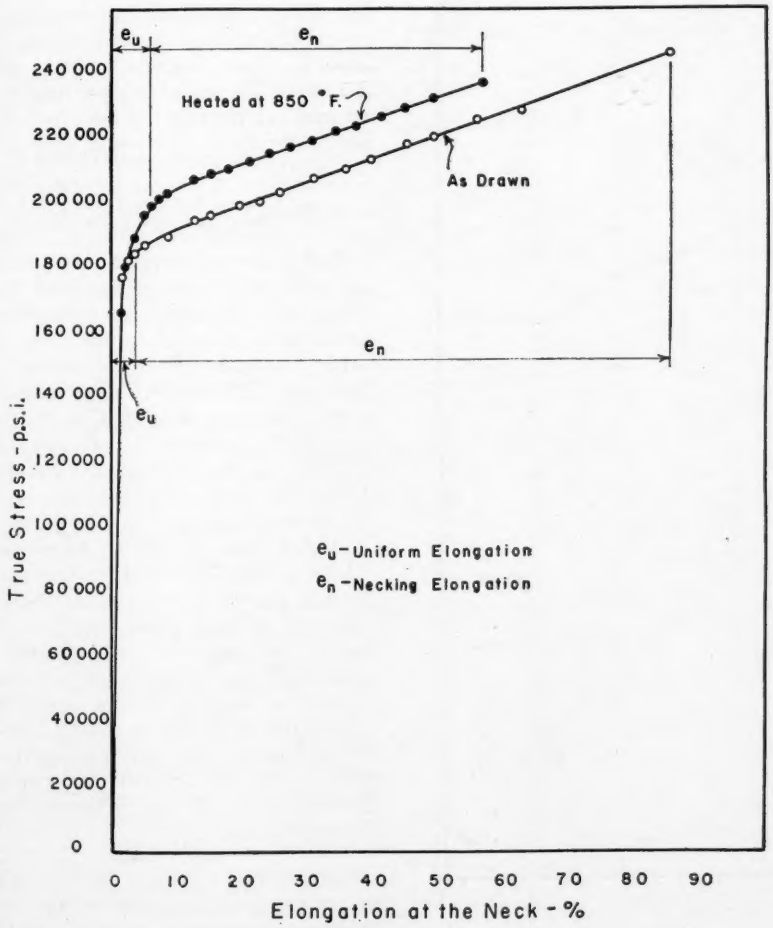


Fig. 7 Tensile Test on .177 in. Diameter Hard Drawn Wire As Drawn and Heated at 850 °F. True Stress — Percentage Elongation at the Neck.

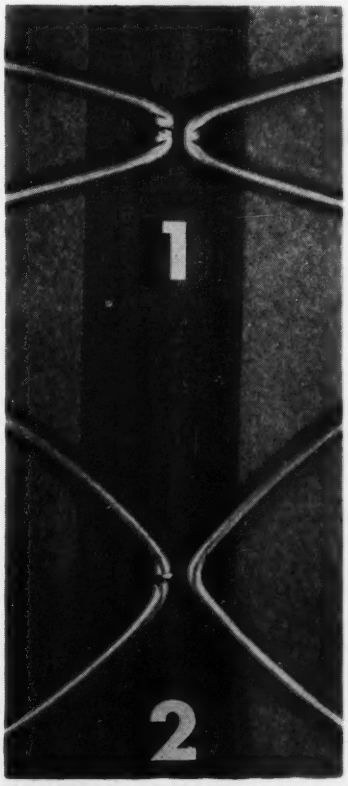


Figure 8. — • • • • • •

**The** results of these comparative tests for ductility indicate that the usual elongation measurement cannot be used as a satisfactory index of ductility when comparing materials processed by different methods.

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**It should** be pointed out that although the heated wire was less ductile than the hard drawn wire, it was still sufficiently ductile to wrap on its own diameter. The heated wire would therefore be satisfactory for many purposes.

## Value of Elongation Test

**Although** the above tests indicate that the usual elongation test is not always a satisfactory index of ductility, we cannot discount the test entirely. Where comparative tests are being made on like materials we find that the test does have significance.

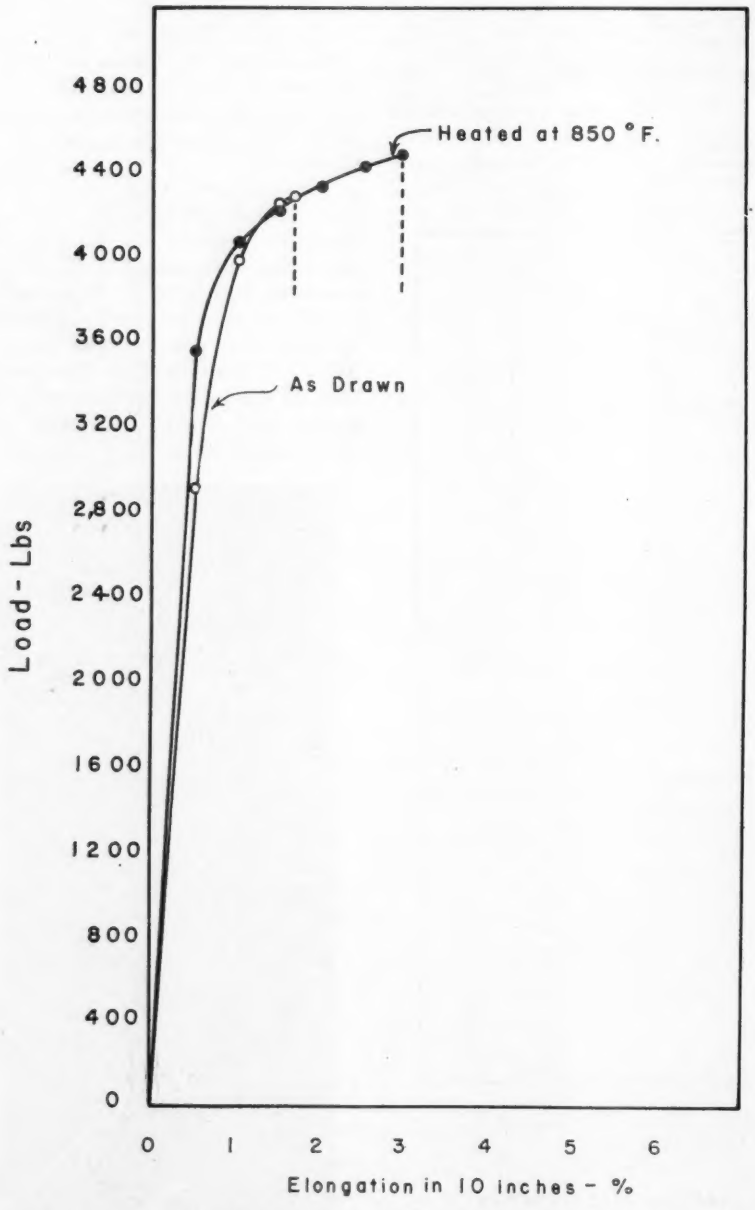


Fig. 9 Tensile Test on .177 in Diameter Hard Drawn Wire Notched Specimens

**For** illustration we are presenting additional tests on the .177" diameter wire in the as-drawn condition and after heating. These materials were tested after machining a surface defect on the surface of the wires. The surface defect consisted of a circular 60° notch around the circumference of the wire to a depth of .007 inches.

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**The** results of load-elongation tests on the notched specimens are presented in Fig. 9, which shows that the notched specimens failed with considerably less elongation than the un-notched specimens (see Fig. 6). This test indicates that any localized defect which results in a decrease of the tensile strength will reduce the elongation considerably.

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**The** elongation requirement was probably originally intended to indicate such localized defects—mechanical, chemical or metallurgical in nature. The elongation test can, therefore, be of value providing the normal elongation value for the particular type of wire in question is known.

## True Elongation or True Strain

**Both** the percentage elongation in a 10 inch gage length and the elongation at the neck described above have been computed from an original gage length or from an original area. This method of computing strain or true deformation is not technically correct as can be explained by the following example:

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**Let** us assume that we have a material such as rubber or plastic, which is capable of stretching uniformly to twice its original length. Starting with a gage length of 10 inches the first one inch of stretch would be equivalent to a 10% increase in length. If the specimen continued to stretch to a total length of 19 inches, the next one inch of the stretch would also be equivalent to 10% of the original gage length.

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**It is** quite obvious that the first one inch of stretch and the last one inch of stretch are not equal. Actually the last one inch of stretch took place over a 19 inch gage length and is thus equivalent to only 5.25% elongation.

For small amounts of elongation this factor is of no consequence but for large deformations such as occur in the neck of a tensile specimen the method of computation has considerable effect on the value obtained. P. Ludwig* and C. W. MacGregor** have presented a method of computing true strain which accounts for the changing gage length.

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According to Ludwig and MacGregor, the

$$\text{True axial strain} = \text{Log}_e \frac{L}{L_o}$$

where $L_o$ = original gage length, and
$L$ = gage length at any instant.

This formula is correct up to the point of necking.

$$\text{The true reduction of area} = \text{Log}_e \frac{A_o}{A}$$

where $A_o$ = original area, and
$A$ = area at any instant.

This formula is correct for the entire range of the tensile test and since for most engineering metals the volume does not change with plastic deformation—

true axial strain = true reduction of area.

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A comparison between true strain and the elongation at the neck is presented in Fig. 10 and illustrates that true strain is significantly less than the percentage elongation at the neck, particularly where deformations are large.

## Additional Tests

The average of a number of ductility tests on four sizes of hard drawn wire in the as-drawn condition and after heating to 850°F for 30 seconds are presented in Fig. 11. The bend test, torsion test and reduction of area indicate that the heated wire has less ductility than the as-drawn wire whereas the percent elongation in 10 inches indicates an increase in ductility after heating.

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The true strain was also determined on each of the four wires and the results of these observations are presented in Fig. 12. The data shows that whereas the uniform strain increased after heating, the necking strain decreased. Although the uniform strain is small compared to the necking strain, the uniform strain takes place over the entire gage length and for this reason results in a large increase in the percentage elongation in a given gage length. The necking strain conversely does

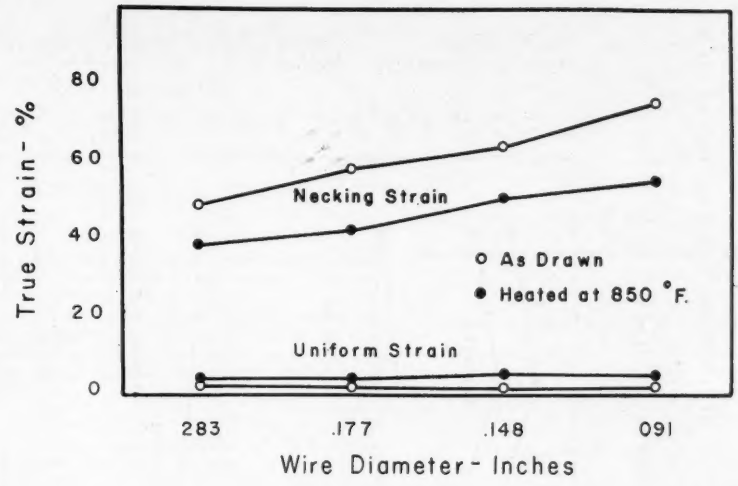



Fig. 12 Ductility of Hard Drawn Wire Measured by True Strain

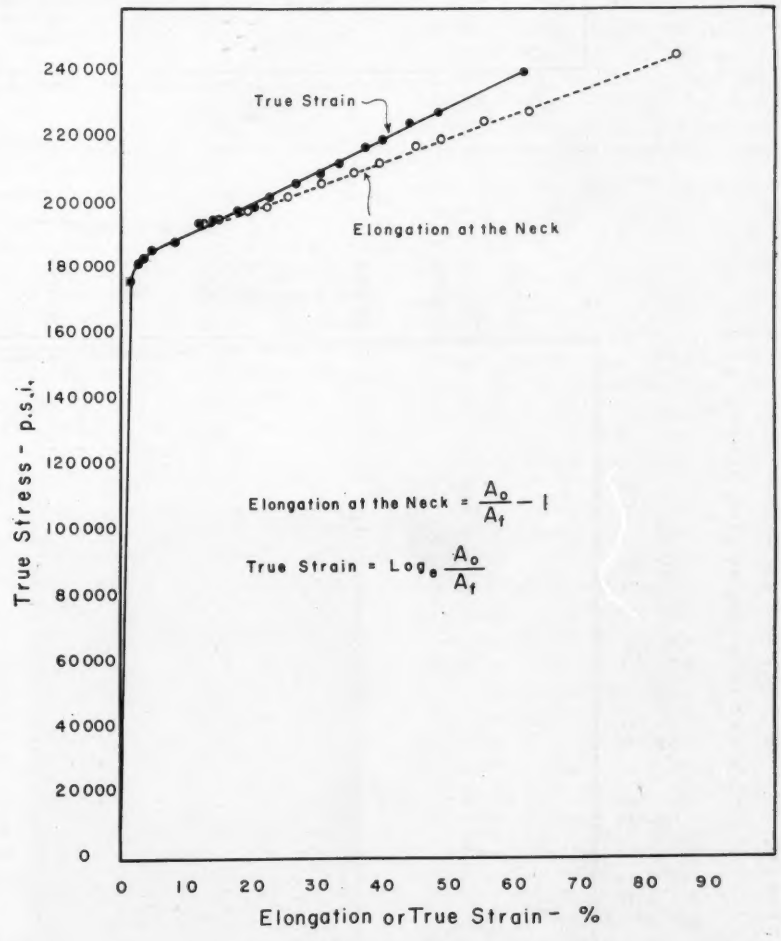



Fig. 10 Comparison between True Strain and Elongation at the Neck.

*'Elemente der Technologischen Mechanik'—by P. Ludwig, Julius Springer, Berlin, 1909.

**"The Tension Test"—by C. W. MacGregor, Proc. Am. Soc. for Testing Materials, Vol. 40, p. 508-534, 1940.

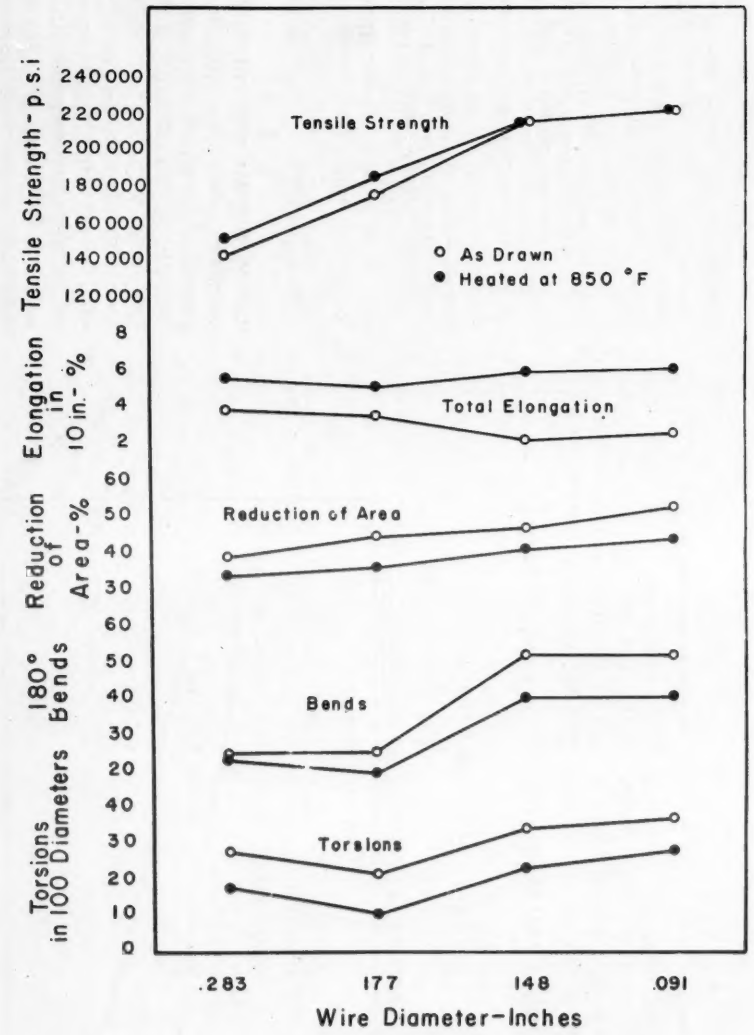
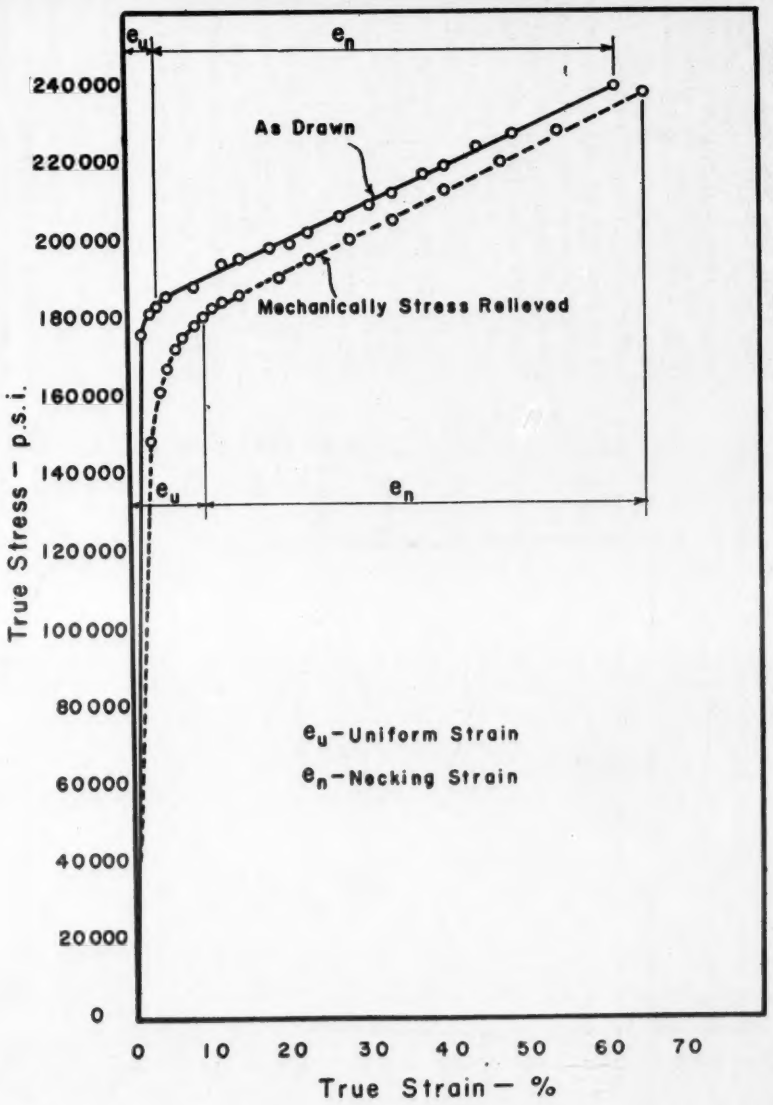



Fig.11 Tensile Strength and Ductility Indicies of Hard Drawn Wire.




(Please turn to page 1131)

Fig.13 Tensile Test on Hard Drawn Wire As Drawn and Mechanically Stress Relieved.

# ACSR Wire

by Frank E. Weise, Jr.—Rod & Wire Mills
Detroit Steel Corp., Portsmouth Division
Portsmouth, Ohio

**A paper delivered before The Wire Association Convention in Cleveland, Ohio, on November 11, 1952.**

**Mr. Weise was born in Pittsburgh, Pa. He attended University of Pittsburgh and secured a B.S. in Metallurgical Engineering from Lehigh University, Bethlehem, Pa.**

**First worked for Steel City Gas-Coal Company, Pittsburgh, Pa. as Asst. Mine Master Mechanic. Joined 1941 College Graduate Operations Training Course of Bethlehem Steel Co., worked Bethlehem, Pa. Plant, Steelton, Pa. Plant, Williamsport, Pa. Plant in various positions in operating, engineering and metallurgical departments until Asst. to Wire Mill Supt. in 1946. Taught Evening Engineering School 1942-43 for Pennsylvania State College. Joined Portsmouth Steel Co., Portsmouth, Ohio in 1948 as Rod & Wire Mills Metallurgist. In 1950 became Asst. to Supt., Rod & Wire Mills, Detroit Steel Corporation.**

**One** of the more significant and important types of steel wire produced in the wire industry is zinc coated steel reinforcing core wire for aluminum conductors, commonly called "ACSR" wire. This wire is used for mechanical reinforcement of the aluminum conductor wire.

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**ACSR** wire is a round high tensile galvanized steel wire in special weight coils. Two types of wire are produced to reinforce the conductor: type "SW" which means single wire, and type "MW" which means multiple wire. Type SW is used for single wire or multiple wire cores, whereas type MW is used only for multiple cores. The diameter of the steel wire varies normally from .0525″ to .1878″ depending upon the size required by the cable manufacturer.

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**The** wire is drawn from steel produced by the open hearth furnace process, usually to the following chemical requirements:

| | |
|---|---|
| **Carbon** | **0.50% to 0.75%** |
| **Manganese** | **0.50% to 1.10%** |
| **Silicon** | **0.10% to 0.30%** |
| **Sulphur** | **Not over 0.050%** |
| **Phosphorous** | **Not over 0.040%** |

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**This** steel is rolled to rod size from selected billets, the rod size being determined by the physical properties of the finished galvanized steel wire. An example would be using 11/32″ rod for .1878″ finished ACSA wire, 5/16″ rod for .1490″ wire, ¼″ rod for .1299″ wire, and No. 5 rod for .1029″ wire. Of course, the coil weights of the rod vary with the section and length of the billets. We have found that due to the special coil weight requirements, it is necessary at times to weld the rod coils prior to patenting.

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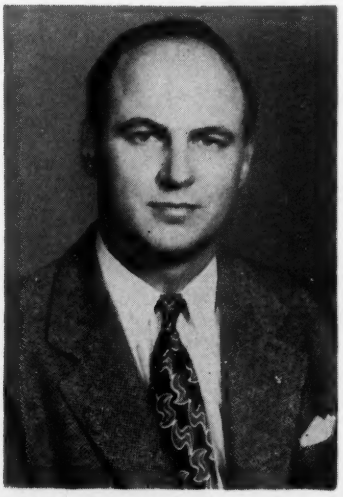
**The** metallurgical requirements of steel soundness and proper rolling technique cannot be overstressed. Proper discards and cropping are practised with frequent checks to insure premium quality. The hot rolled rod is trimmed at both end on the rod conveyor and samples of each end of each coil of rod for ACSR wire are subjected to numerous tests. The size, roundness, fracture test for steel soundness, and visual inspection are made at the conveyor with samples from each rolling of each heat checked for chemical analysis, etched for surface and rolling marks, and small sections of each rod referred to as "buttons" are upset to check for laps, seams, surface, etc.



Frank E. Weise, Jr. * * * *

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**After** the rod is rolled and the steel proven satisfactory for ACSR wire, the material is then heat treated by a process called "patenting". Various types of patenting can be employed, but we have found that precisely controlled patenting using a lead quench, commonly called "lead patenting", imparts superior qualities to the rod. The steel rod is patented to the desired tensile range, which for quality ACSR wire we have found to be 150000 to 165000 pounds per square inch. During the patenting operation it is very important to keep the strands separated to give uniformity.

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**The** rods are then cleaned and coated for drawing. We have found borax to be a satisfactory coating material for this application.

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**Wire** drawing is done on adequately cooled continuous machines and the actual practice depends upon the finished size and specified physical properties. Examples of this practice to give a quality product is drawing 11/32″ lead patented rod five drafts to .162″, 1/4″ lead patented rod four drafts to .125″, and No. 5 lead patented rod five drafts to .101″. The ends of the rod coils are electric butt welded on the flipping boom, with the drawn wire on the finishing block having the drawn welded section cut out for type SW material and allowed to remain in the wire for type MW. All machines drawing ACSR wire are equipped with automatic counters which stop the ma-

CHART 1 ACSR WIRE FLOW CHART

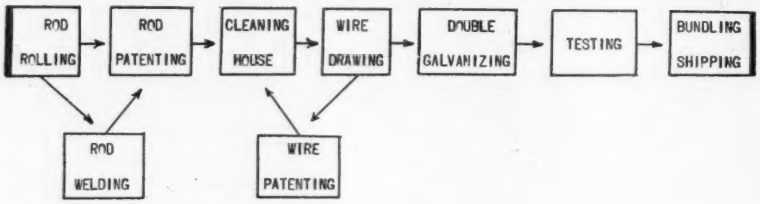


CHART 2 - BRIGHT WIRE SIZE VS. GALVANIZED SIZE

| Drawing Range | Zinc Thickness Range | Zinc Coating Range | Galv. Finished Size |
|---|---|---|---|
| .182" - .186" | .00173"/.00217" | 1.10/1.25 oz./sq.ft. | .1878" ± .003" |
| .162" - .166" | .00156"/.00199" | 1.00/1.15 | .1670" ± .003" |
| .144" - .148" | " | " | .1490" ± .003" |
| .134" - .137" | .00147"/.00191" | .95/1.10 | .1384" ± .002" |
| .132" - .134" | " | " | .1360" ± .002" |
| .129" - .131" | " | " | .1327" ± .002" |
| .125" - .127" | .00147"/.00191" | .95/1.10 | .1291" ± .002" |
| .122" - .124" | " | " | .1261" ± .002" |
| .117" - .119" | " | " | .1214" ± .002" |
| .111" - .113" | .00139"/.00173" | .85/1.00 | .1151" ± .002" |
| .114" - .116" | " | " | .1182" ± .002" |
| .110" - .112" | " | " | .1138" ± .002" |
| .107" - .109" | " | " | .1111" ± .002" |
| .1045" - .1065" | " | " | .1085" ± .002" |
| .101" - .103" | " | " | .1054" ± .002" |
| .099" - .101" | .00131"/.00164" | .85/.95 | .1030" ± .002" |
| .096" - .098" | " | " | .1000" ± .002" |
| .094" - .096" | " | " | .0977" ± .002" |
| .092" - .094" | " | " | .0961" ± .002" |
| .091" - .093" | " | " | .0949" ± .002" |
| .088" - .090" | " | " | .0921" ± .002" |
| .085" - .087" | .00121"/.00147" | .75/.85 | .0892" ± .002" |
| .083" - .085" | " | " | .0862" ± .0015" |
| .082" - .084" | " | " | .0852" ± .0015" |
| .080" - .082" | " | " | .0834" ± .0015" |
| .075" - .077" | " | " | .0788" ± .0015" |
| .071" - .073" | .00112"/.00139" | .70/.80 | .0743" ± .0015" |
| .067" - .069" | " | " | .0703" ± .0015" |
| .0625" - .0645" | " | " | .0661" ± .0015" |
| .0565" - .0575" | " | " | .0589" ± .0010" |

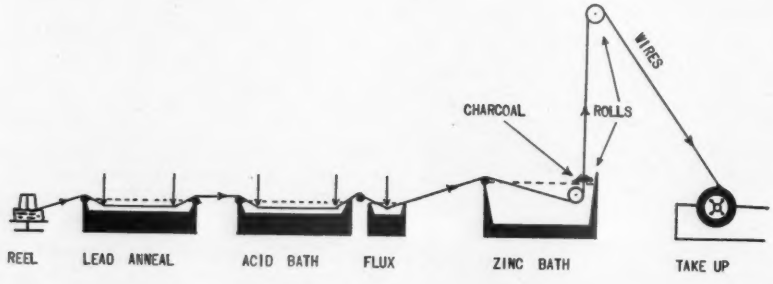


CHART 3 TYPICAL DOUBLE GALVANIZING UNIT

CHART 5 - RESULTS IN WEIGHING 60 COILS OF .1327" ACSR

| Operation | Average Weight | Average % Loss or Gain | Average Lbs. Loss or Gain |
|---|---|---|---|
| Billet | 343.0 | - | - |
| Hot Rolled Rod | 326.6 | - 4.8 | - 16.4 |
| Patented Rod | 321.4 | - 1.6 | - 5.2 |
| Drawn Wire | 314.0 | - 2.3 | - 7.4 |
| Galvanized Wire | 324.0 | + 3.2 | + 10.0 |

chine when the required length is drawn to give the desired bundle weight for MW wire where the welds are permitted to be drawn into the finished wire. Each coil of wire is individually weighed and tagged by the wire drawer to be positive the coil is within the weight tolerance to give the specified galvanized coil weight. A gauger inspects each truck of bright drawn wire for gauge, finish, and spot checks for tensile and ductility.

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**Inasmuch** as all sizes of wire cannot be drawn directly from rod to size to give a quality product, certain finer sizes are drawn from a patented wire. The breaking point varies with wire manufacturers, depending on the steel analysis, rod size, steel quality, drawing equipment, etc. We have found that .0885″ wire can be drawn from a No. 5 patented rod whereas it is better for .0788″ wire to be drawn from a patented wire for a quality product. Listed on Chart 2 are the size tolerances for the bright wire prior to charcoal galvanizing for several representative sizes of ACSR wire.

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**The** bright wire is delivered to the galvanizing department with each truck correctly identified as to the customer and customer requirements—each coil on the truck is tagged with the weight of the coil, heat number and steel grade. The wire to be galvanized is then placed on the reel, passed through a lead-strand annealing furnace, through a continuous cleaning and washing operation, through the zinc bath, and then rewound on a 36 block take-up unit. A diagram of a typical charcoal wipe galvanizing unit is shown in Chart 3.

★ ★ ★

**Reels**, sometimes called "swifts", are very important to good operations. The pay off is accomplished by utilizing revolving reels. A free moving reel with some type of brake, so that a slight tension can be given the running wire, is satisfactory. Finer gauges of wire can be hand spliced cold whereas it has been found advantageous to use an electric resistance heating unit to facilitate hand splicing on the larger sizes of wire. Although the bright

wire size varies over a wide range, it is more practical to draw all wire on a standard size block so that a standard reel can be used for all sizes of wire behind all the various galvanizing units.

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**The** running wires leave the reel and pass into a lead annealing furnace. Desired physical characteristics are developed by a proper combination of time and temperature in the lead. This must be closely controlled using modern automatic temperature controls and constant supervision. This temperature treatment lowers the tensile strength of the steel wire 20/30000 pounds per square inch, and increases its elongation to meet physical requirements.

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**As** the wires leave the lead bath a proper wipe is used to remove all traces of hot lead from the steel wire. This eliminates lead drag and improves the quality of the zinc coating.

★ ★ ★

**The** wires leaving the lead annealing furnace pass into a strand cleaning operation or the so-called "acid house". The acid dip gives a clean bare steel surface which is essential for tight zinc adherence. A steel tank, rubber lined, with an inner lining of acid brick to protect the rubber is used to hold the acid. The heating unit is a closed system using a carbon steam heating element.

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**The** temperature of the acid is maintained at 130/160 degrees F. The strength of the acid is tested periodically by a simple titration against a caustic solution and the required muriatic acid is added to give a strong active bath. This strength is maintained until the iron content is too high to give a quality product, at which time it is renewed. Precise control of the acid is maintained for adequate cleaning at all times. The strands of steel wire leaving the acid bath pass through a small flux tank. We have found a zinc chloride solution kept active by muriatic acid and metallic zinc has proven most effective. The wires then pass over a drier into the zinc bath. It is also advantageous to have tension rolls prior to or just after the acid house to reduce vibration and to keep the wires properly

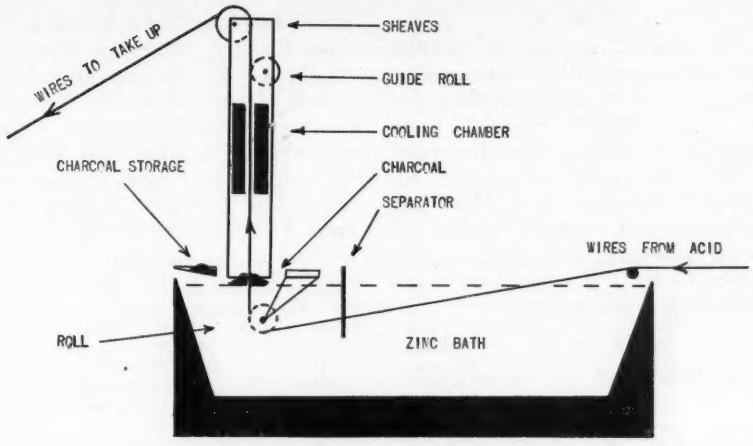


CHART 4 DETAIL OF GALVANIZING HEADER

CHART 6 - SAMPLE ACSR PHYSICAL REQUIREMENTS**

| Size | Tolerance | Tensile (p.s.i.) | Stress 1% Elong.(p.s.i.) | Coating Wt. | Elong. | Preece | Bends |
|---|---|---|---|---|---|---|---|
| .0788" | .0015" | 190000 | 170000 | 0.70 oz.sq.ft. | 4% | 3-1/2 | 20 |
| .1029" | .0020" | 190000 | 165000 | 0.75 oz.sq.ft. | 4.5% | 4 | 10 |
| .1360" | .0020" | 190000 | 160000 | 0.85 oz.sq.ft. | 5% | 4 | 7 |
| .1672" | .0030" | 190000 | 160000 | 0.90 oz.sq.ft. | 5% | 4 | 5 |
| .1878" | .0030" | 190000 | 160000 | 1.00 oz.sq.ft. | 5% | 4 | 4 |

**From ASTM Designation: B 245 - 49T - 1949 (Preece & Bend Tests - Detroit Steel Corporation Standards).

CHART 7 - COIL WEIGHTS FOR PRODUCING ACSR WIRE

| Bundled Wire Coil Wt. Range | Galvanized Wire Coil Wt. Range | Bright Drawn Wire Coil Wt. Range | Hot Rolled Rod or Welded Coil Weight Prior Patenting Range (SW Only) |
|---|---|---|---|
| 96/104 lbs. | 300/312 | 290/302 | 305/315 |
| 115/126 lbs. | 360/375 | 345/360 | 365/380 |
| 159/171 lbs. | 330/342 | 320/332 | 335/345 |
| 173/187 lbs. | 360/374 | 345/360 | 365/380 |
| 207/223 lbs. | 430/446 | 410/426 | 430/450 |
| 192/208 lbs. | 400/316 | 385/401 | 400/415 |
| 221/239 lbs. | 460/478 | 440/460 | 460/480 |
| 288/312 lbs. | 300/312 | 290/302 | 305/315 |
| 317/343 lbs. | 330/343 | 320/332 | 335/345 |
| 346/374 lbs. | 360/374 | 345/360 | 365/375 |
| 384/416 lbs. | 400/416 | 385/401 | 400/415 |

CHART 8 - SAMPLE ACSR DATA**

| Steel Wire Size | No. Steel Wires | Desired Length Steel Wire | Nominal Coil Wt. Lbs. | Wt. Var. in Coils | Type of Wire | Aluminum Wire Size | No. Aluminum Wires |
|---|---|---|---|---|---|---|---|
| .0525" | 1 | 13650 Ft. | 100 | 4 lbs. | SW | .0525" | 6 |
| .0661" | 1 | 17250 Ft. | 200 | 8 lbs. | SW | .0661" | 6 |
| .0788" | 7 | 12100 Ft. | 200 | 8 lbs. | MW | .1013" | 26 |
| .0885" | 7 | 9600 Ft. | 200 | 8 lbs. | MW | .1138" | 26 |
| .1000" | 7 | 7550 Ft. | 200 | 8 lbs. | MW | .1000" | 30 |
| .1052" | 1 | 5620 Ft. | 200 | 8 lbs. | SW | .1052" | 6 |
| .1216" | 7 | 5050 Ft. | 200 | 8 lbs. | MW | .1564" | 26 |
| .1327" | 1 | 6440 Ft. | 300 | 12 lbs. | SW | .1327" | 6 |
| .1362" | 7 | 4060 Ft. | 200 | 12 lbs. | MW | .1362" | 30 |
| .1490" | 1 | 5100 Ft. | 300 | 12 lbs. | SW | .1490" | 6 |
| .1670" | 1 | 4050 Ft. | 300 | 12 lbs. | SW | .1670" | 6 |
| .1878" | 1 | 3210 Ft. | 300 | 12 lbs. | SW | .1878" | 6 |

**Not a standard specification - to illustrate relationship of steel to aluminum wires.

separated.

★ ★ ★

**Our** galvanizing pan or "kettle" holds approximately 50 tons of zinc. The zinc used in the galvanizing pan for quality ACSR wire must be High Grade Virgin zinc. Inasmuch as the zinc quality is of such importance, the zinc should be properly ordered, sample plates analyzed prior to use, and periodic checks made of the zinc bath to insure proper galvanizing.

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**The** wires pass over an adjustable roll across the entrance end of the spelter pan, into the molten metal through submerged wire separators, under the sinker roll, then vertically through the charcoal header, then down to the take-up unit. This header rests on the exit end of the spelter pan and rises vertically about seven feet. Chart 4 illustrates the relative positions of the various components of the header. The submerged wire separators are located just prior to the sinker roll to keep the wire properly spaced. After the wires pass through the separator they go underneath a roller sinker made of reinforced double strength steel pipe. This roll is twelve inches in diameter with a plain surface. We have found a smooth surface roll more satisfactory than a roll grooved for each individual wire. This roll is actually a floating roll with a carbon one-half upper bearing having a loose steel strap as the lower bearing which is used only to position the roll. Many different types of bearings are being used in the wire industry but we have found the carbon bearing to be quite satisfactory and gives several weeks of service, while the roll will give months of service if properly used.

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**The** top of the roll is located approximately six to eight inches below the surface of the metal so that zinc skimmings on the surface are not dragged into the bath by the turning roll. Conversely, the bottom of the roll has to be of sufficient clearance from the bottom so that zinc dross does not stir with the turning roll giving a rough surfaced wire.

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**The** charcoal wipe is about three to four inches deep and about eight inches wide spreading entirely across the pan. The wires pass vertically through this wipe forming a small cone at the exit of the wipe which tends to smooth the zinc coating on the steel wires. Various mixtures of charcoal, fly ash, and oil can be successfully used as a wipe. The mixture is kept in an open box adjacent to the wipe on the end of the zinc pan so that it is readily added to the wipe as needed, and kept slightly warm.

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**The** wires continue vertically and as the zinc flows down the wire and becomes smooth they pass through a cooling chamber which freezes the zinc into a bright smooth coating. The wire proceeds vertically past individual sheave guides which line the wire vertically from the sinker roll through the charcoal wipe, then over the top roll seven feet above the level of the spelter bath and onto the 36 wire take-up unit.

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**The** length of the immersion in the zinc bath determines the weight of coating and Preece value. Obviously this, of course, is varied to meet the specification requirements. An insulating material covers the bath to reduce zinc skimmings and to conserve heat. The temperature of the zinc is kept at approximately 850 to 880 degrees F. To meet the requirements of ACSR wire, it will be found that the weight of the zinc on the steel is approximately 3 to 8% of the weight of the galvanized wire depending on the wire size. Dross consumes some zinc depending on operating conditions and continually settles to the bottom of the zinc pan. This dross is removed once a week using an overhead crane hoisted shovel. Of course, prior to drossing, the submerged separator and sinker roll are removed as is the case at any time the unit is not operating, while the header remains in position during drossing.

★ ★ ★

**The** wires leaving the header may go directly to each take-up block, or all the wires may go to the opposite end of the take-up frame and reverse to each take-up block. The latter method appears to us to give the better results. The galvanized wires pass over a sheave immediately prior to going onto the take-up blocks. Our standard block size is 27″, with the exception that finer gauges of ACSR wire may be on a 22″ block.

★ ★ ★

**The** speed of operations depends on many factors, the most important being that of fulfilling the physical and coating requirements of the galvanized ACSR wire. Another factor is vibration in the take-up frame or anywhere along the path of travel of the wire from reel to take-up block. The speed of galvanizing is usually from 30 to 50 feet per minute depending on the wire size. For good operations, it is highly recommended not to galvanize at one time two sizes that have a wide difference in gauge, but if this practice must be followed, then the speed usually is determined by that of the larger size of wire.

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**Chart 5** lists the results of sixty coils of rod, each coil weighed after each operation which illustrates normal expectations of weight variation when making special weight coils of ACSR wire.

★ ★ ★

**The** coils of galvanized wire are stripped from the take-up blocks by using an electric hoist so that the coils do not touch the floor. Also, prior to stripping a coil from the block, it is recommended to allow a few strands of the new coil to build up on the block so that when the wire is cut at the splice it does not cause any vibration or slipping which would create a rough spot at the charcoal wipe. The coils of galvanized wire are then placed on racks to be moved to the bundling area; the racks are covered first with clean paper to prevent the wire from becoming "scuffed or dirtied".

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**The** testing of ACSR wire is conducted on samples taken at the galvanizing blocks to insure a good quality product meeting customer specifications. The physical requirements are very rigid on this material with the finished galvanized wire being subjected to numerous tests. Each coil is inspected for sur-

*(Please turn to page 1130)*

# Effect of Certain Impurities on Free Cutting Brass

by Grayson B. Wood, Jr., Metallurgist,
Scovill Mfg. Company
Waterbury, Connecticut

**Mr. Wood graduated from Purdue University in 1942 with a degree of B.S. in Metallurgy. After service with the Army Air Force he joined the Scovill Manufacturing Company in 1946 and is working as a metallurgist in the Technical Service Division of the Metals Research Department. His paper, concerned with the effects of impurities introduced into the brass through the poorer grades of copper they are forced to use due to the copper shortage, was delivered at the Wire Association Convention in Cleveland, Ohio, on November 12, 1952.**

## Effect of Certain Impurities on Free Cutting Brass

**The copper** shortage of the past year or so has been forcibly brought home to many users of the various copper base alloys through increasingly difficult procurement and in some cases by the necessity for the substitution of other alloys. There are other phases or effects of this shortage, however, which although they have not attained sufficient magnitude to seriously affect the consumer, are of prime importance to the producers. Along with the much publicized shortages of raw copper, there was a natural decline of copper base alloy scrap, an important factor in the economical production of brass mill products. In the production of Free Cutting Brass, for example, the brass mills found it necessary to use a poorer grade of scrap than that ordinarily utilized, resulting in the gradual increase of impurity contents in the finished product. The more common impurities of iron, nickel, and tin increased to the point where specification limits were approached and at times exceeded. Furthermore other elements, particularly aluminum, were detected from time to time in the routine analyses made on extrusion billets.

★ ★ ★

**Simultaneous** with this buildup of impurities, mill processing difficulties were encountered which were attributed to the presence of impurities. Point breakage during drawing became more frequent, necessitating changes in annealing times and temperatures. Finish anneals requiring definite grain sizes or mechanical properties had to be revamped to meet specifications.

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**In some** cases where exceptionally soft material was desired it was even found necessary to establish relatively low impurity limits requiring the selection of extrusion billets by analysis.

★ ★ ★

**With** the buildup of impurities plus the mill processing difficulties which were being encountered it was felt that there was a definite need for investigation of the effects of these impurities on the operations commonly performed by the consumers. As a starting point for these investigations, Free Cutting Brass, the standard screw machine alloy containing a nominal 62% copper, 3% lead, balance zinc, was selected. This choice was based on the fact that, since relatively few cold working operations requiring high ductility are performed on the alloy, the majority of the low grade scrap is utilized in the casting of the extrusion billets. Furthermore, for much the same reason, the scrap content of the charge constitutes a larger percentage than it does in most other alloys.

Grayson B. Wood, Jr. * * * *

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**Since** the principal operations performed on Free Cutting Brass are machining and drawing and annealing, test procedures were set up to determine the effects of the impurities on these specific operations. The first of these impurities to receive attention was iron. For some time there has existed a major difference in the specification limits on iron content between the ASTM standards B-16 and the government specifications QQ-B-611a and MIL-B-895, the former having a maximum of 0.15% on the iron content whereas the government specifications allowed 0.35% and 50% respectively. Since the additional 0.20% allowed under the government specifications was more than enough to alleviate the casting problems it was hoped that with some indication that the increase would not seriously affect the finished product, a relaxation of the ASTM limits might be obtained.

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**From** published literature and mill experience it was known that grain growth and hence softening during annealing is retarded by the presence of iron. This can be readily overcome however by the simple expedient of increasing annealing times and temperatures. Only in rare instances where extremely soft material is desired does it become necessary to control the iron content to the lower specifications limit.

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**To determine** the effect of the iron on machinability, two special lots of Free Cutting Brass were cast, one containing iron contents between 0.10-0.15% and the other between 0.30-0.35%. A production job was then selected in the automatic screw machine department which required a relatively long forming operation.

A print of the job is shown in Figure I. The material used was 5/8" round in the standard half hard temper.

★ ★ ★

**During** the two week run on each lot, accurate production figures were kept showing down time for tool sharpening and for tool adjustments. In addition samples were obtained at regular intervals beginning immediately following a sharpening of all tools and ending, at the operator's discretion, when the work surface had reached a point where another tool sharpening was indicated. These samples were then subjected to testing on a profilometer to determine the degree of surface roughness and the rate at which this roughness increased.

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**It will** be noted from these figures that the number of sharpenings as well as the down time for sharpening is essentially the same for both lots. The major difference appears to lie in the amount of adjustment necessary to hold tolerances. This may be due to a higher resistance to tool penetration on the high iron content rod with a resulting tendency to force the tools back in the supports.

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**The** results obtained on the profilometer are plotted on the attached graph (Fig. 2). No major differences in the two lots are indicated by this plot, although the wear rate appears higher at the beginning of the run on the high iron material. This rate tapered off, however, so that for the entire run, the rates were approximately equal for both lots. The rapid wear at the outset might be due to too fine an edge on the tool which would show an initial high rate.

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**From** the results obtained on these lots it appears that there is little difference in machinability or tool wear with the iron content varying in the range of 0.10 — 0.35%. Surface finish remained within normal limits for approximately the same length of time and the number of tool grindings in the two week run were about equal. It was concluded that in cases of necessity the change from 0.15% maximum to 0.35% maximum could be made without seriously impairing the machinability of the alloy. However every ef-

**A tabulation** of the production run figures is shown below:

| | Low Iron | High Iron |
|---|---|---|
| Hours run | 97.5 | 94 |
| No. of sharpenings | | |
| Front form | 4 | 5 |
| Rear form | 5 | 5 |
| Cut off | 2 | 3 |
| Down time for sharpening | 3.3 hrs. | 3.6 hrs. |
| % " " " " | 3.4% | 3.8% |
| Down time for adjustments | 2.4 hrs. | 4.9 hrs. |
| % " " " " | 2.5% | 5.2% |

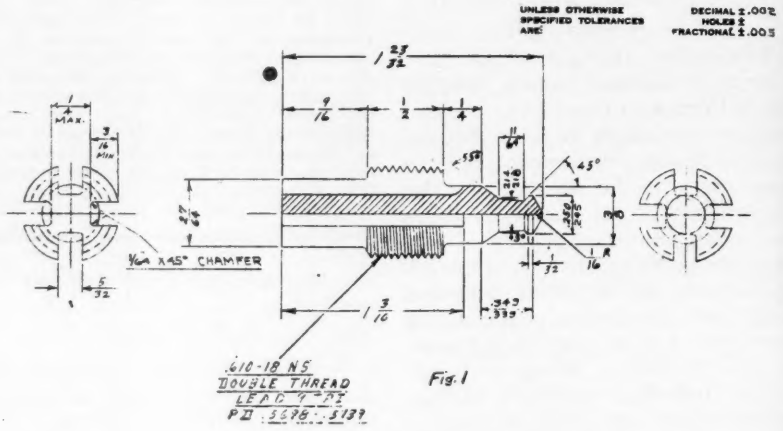



Fig. 1

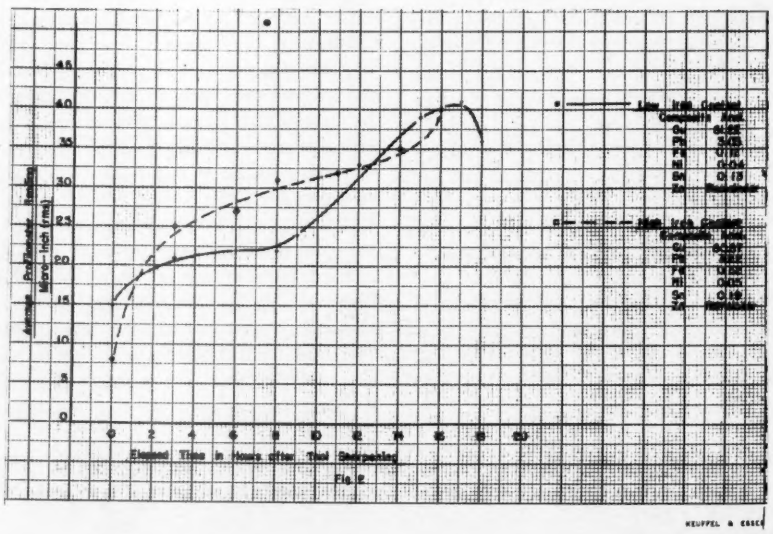



Fig. 2

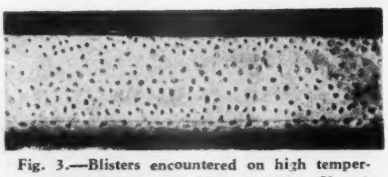


Fig. 3.—Blisters encountered on high temperature salt bath anneal. Mag. Approx. 4X *

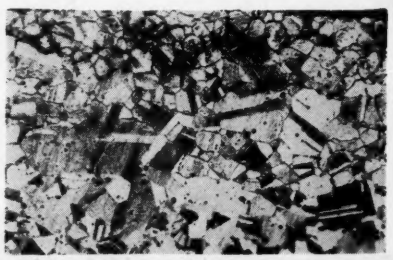
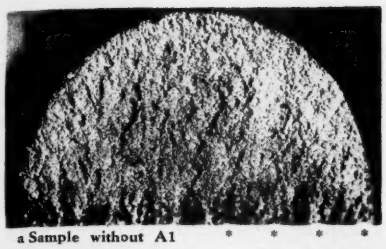


Fig. 4.—Microstructure of blistered rod surface showing inter-crystalline cracking. Mag. 200X Etch $NH_4OH + H_2O_2$ * * * *



a Sample without Al

b Sample with Al

Fig. 5—Nick and Break Tests Mag. Approx 10X

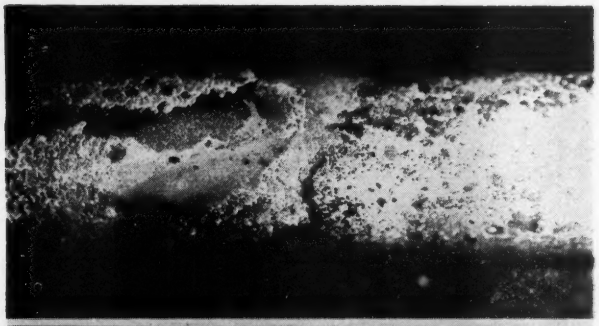


Fig. 6
End in
Salt Bath
700°C.
Mag. Approx. 4X

End in
Salt Bath
760°C.
Mag. Approx. 4X

fort should be made to keep the iron content as low as possible since it does effect annealing cycles appreciably and apparently effects machining operations to the extent that more frequent tool adjustments are necessary.

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**The** next element selected for investigation was aluminum. Very little information was available on this element as an impurity, and, due to its fairly recent appearance, mill experience on aluminum bearing material was limited. A test run similar to that outlined above was set up with the aluminum content varying between 0.10 and 0.20%. After cutting up an appreciable quantity of this material the screw machine department reported that no difference could be detected in either feeds or speeds or in tool wear.

★ ★ ★

**It then** remained to determine the annealing characteristics of rod containing aluminum as an impurity. A series of annealing cycles were established including both atmosphere and salt bath anneals. Grain growth was again retarded with increasing aluminum content although not to the extent that it was retarded by iron content. However during high temperature salt bath anneals it was noted that some of the aluminum bearing material blistered badly as shown by the photograph of Figure 3. An investigation was begun to determine what factors contributed to this blistering phenomenon.

**The first** step was a complete analysis of good and bad coils to determine if other impurities, aside from aluminum, might be involved. With the aid of a spectograph the following analyses were obtained.

| | Good Coils | | Bad Coils | |
|---|---|---|---|---|
| | #1 | #2 | #3 | #4 |
| Copper, % | 61.70 | 62.10 | 62.32 | 62.74 |
| Lead, % | 3.03 | 2.93 | 3.10 | 3.21 |
| Iron, % | 0.12 | 0.12 | 0.14 | 0.14 |
| Nickel, % | 0.05 | 0.05 | 0.07 | 0.07 |
| Tin, % | 0.05 | 0.13 | 0.16 | 0.13 |
| Aluminum, % | Trace | Trace | 0.103 | 0.068 |
| Antimony, % | Trace | Trace | 0.0073 | 0.0062 |
| Bismuth, % | Trace | Trace | Trace | Trace |
| Silicon, % | 0.004 | 0.003 | 0.004 | 0.004 |
| Zinc, % | Remainder | | Remainder | |

(*Please turn to page* 1128)

Fig. 7—Mag. Approx 4X—840°C. End in Salt Bath

Fig. 8—With Aluminum 800°C. Mag. Approx 4X Ends in Salt Bath

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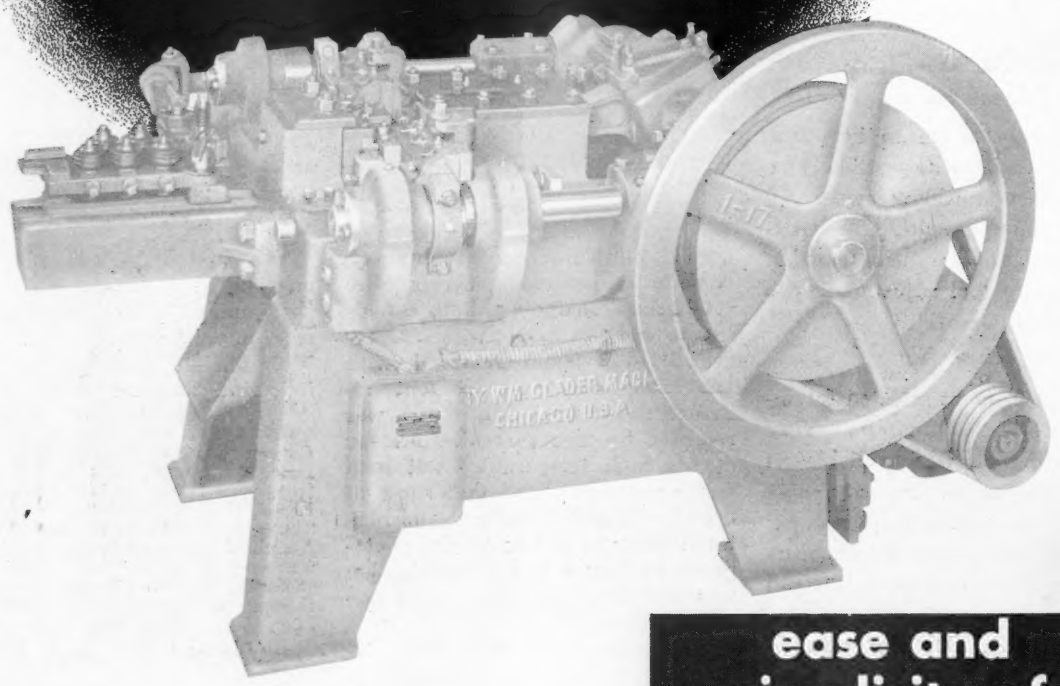

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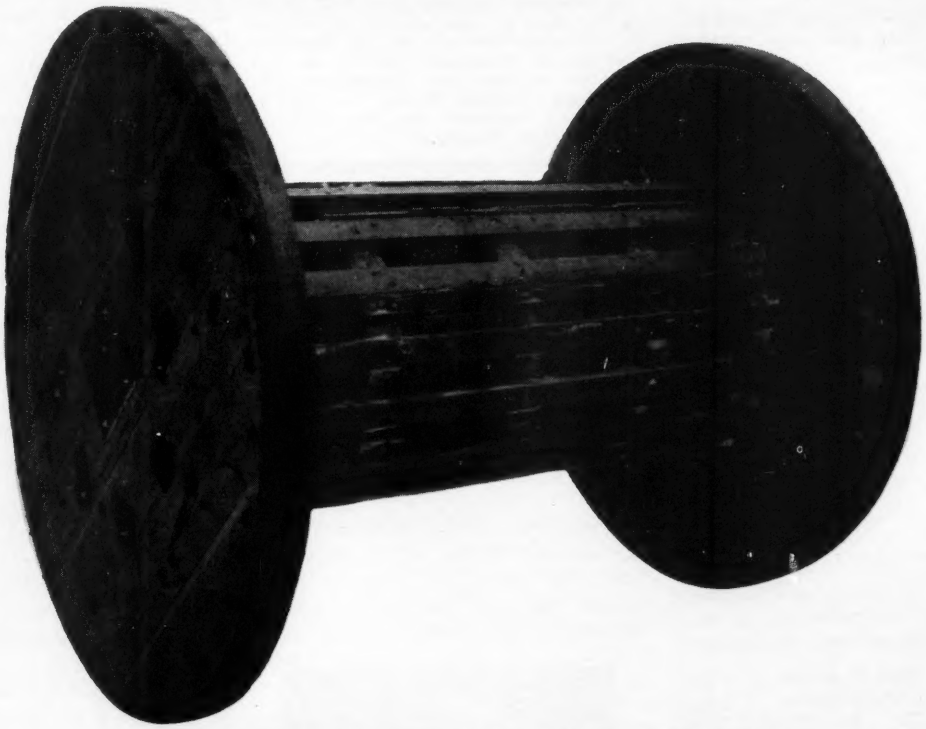

*Picture shows one of the largest wooden reels ever used in Canada. Designed and built by us to carry 28 tons of cable. The reels alone weighed 3 tons each, measuring 108" in diameter, with a 54" drum and a 104" traverse.*

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# THE CONTROL OF WIRE DRAWING SOLUTIONS FOR COPPER

by Robert C. Williams
Director of Research
The Ironsides Company
Columbus, Ohio

**Dr. Williams delivered this paper at Cleveland, Ohio, on November 12, 1952, at the Annual Convention of the Wire Association.**

**Robert C. Williams was born in Wooster, Ohio. He is a graduate of Oberlin College. A. B. and A. M., and took his Ph. D. at Stanford University. He has been with The Ironsides Company since 1932. Prior to that date he was a research chemist for Firestone Tire and Rubber Company and Battelle Memorial Institute. He is a member of the Wire Association, the American Chemical Society, the Society of Plastics Engineers, and the American Oil Chemists' Society.**

**Discussions** of the best way to handle copper wire drawing solutions frequently result when wire mill operating men corner a wire drawing compound man. This observer has noticed that marked advances have been generally made in solution handling. This is particularly true over the period of the last 10 to 12 years and has been due in large measure to the fact that many older wire drawing machines have been replaced by modern, higher production units. This, in turn, has caused more, rightful emphasis to be put on solution supply tanks and auxiliary layout to serve these machines.

★ ★ ★

**Some** years ago **Wire & Wire Products** published two papers (1) (2) by the author related to this one. This paper, however, will deal principally with detailed recommendations for the control and handling of solutions which are primarily the soap and emulsified fat type.

## Making Up a Fresh Solution

**Before** starting to make up a new solution, the machines, delivery and return lines and tank should be cleaned as well as time will permit. This should be done because the detergent action of a fresh solution, being greater than that of the old discarded solution, will scour the equipment. This can even result in temporary redeposition of the old sludge in the machines. It is a common experience that the loosened, old sludge deposits which are characterized by a bluish color settle out in the baffled tanks after a few days of operation.

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**The** actual preparation of a new solution requires knowing the approximate volume of solution to be employed and the number of pounds of compound to produce the preferred strength of the operating solution. Suppose the system uses 5,000 gallons of solution, and 50 lbs. of compound per 100 gallons of solution are required to give the preferred operating strength, the job at hand is to disperse the 2500 lbs. of compound as a smooth, non-lumpy solution.

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**Under** no circumstances should the entire 2500 lbs. of compound be put into the main tank without proper "boil-up" procedure. Regardless of the size of the "boil-up" tank, it is recommended that a minimum of 2 parts of water be used for each part of compound. For dispersing the compound to form the smooth, concentrated solution, steam coils for heat and a mechanical agitator are recommended. Actual boiling is unnecessary. If live steam is used for both heat and agitation, steaming should be discontinued as soon as a smooth solution is obtained.

Robert C. Williams

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**This** concentrated solution and the following batches should be run into the tank which may not necessarily contain the final volume of water to be employed. It is preferable in the winter that the water in the tank be warmed slightly, rather than using it ice cold. This warmer water will prevent gelling of the soap in the concentrated solution, particularly if it is a soda soap.

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**It is** not necessary or even desirable to make up the full operating strength before starting to draw wire. Initial foaming may be excessive if a full strength solution is used at the start. It is common practice to start operations with about two-thirds strength and build it up over a period of a day or two.

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## Operational Checking

**Ordinarily**, three checks are sufficient to assure proper solution control: (1) The strength of the solution should be checked by means of the Babcock test; (2) The temperature of the solution pumped to the machines; (3) The pH of the solution.

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**The** strength should be maintained at the Babcock percentage which gives the best results. Some operators check the percentage daily, others less frequently. It is better to make frequent smaller additions of

compound to maintain the strength, rather than larger infrequent additions. Frequent, smaller additions maintain not only an even strength but tend to stabilize the pH.

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**The** recommended maximum temperature of the solution is 130° F. Operating at temperature over 140° F. may result in lessened die life, lower tensile strength of the wire and discolored wire. In certain mills it may be necessary to use heat exchangers for cooling or either added tank capacity or better ventilation of the tanks.

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**Most** mills on a regular operating schedule have little difficulty in maintaining the pH in the preferred operating range—normal additions of compound taking care of this. Best results are generally obtained in the pH bracket of 8.5 — 9.6. On rare occasions pickle acid contamination may cause a drop in the pH, resulting in poor performance and the development of a pronounced green cast to the solution. Long idle periods also result in a pH drop. Compensation for the low pH may be safely made by addition of not more than two ounces of alkali (caustic soda, caustic potash or soda ash) per 100 gallons of solution. Repeated additions, after several hours elapse, may be required.

## Settling of Copper Dust

**The** settling of fine abraded copper particles is aided by the use of idle tanks or by proper baffling of the tanks. A small number of mills employ idle tanks to "rest" a solution from time to time. This permits both copper and sludge settling and the usable solution can be pumped off and used again. A long resting period is very undesirable and a few days to one week should be adequate. An idle solution gradually deteriorates. The fat slowly hydrolyzes, producing fatty acid, thereby reducing the pH. Carbon dioxide from the air also reduces the pH. Since there is no wire being drawn through the idle solution, there is no fatty acid being removed on the copper, and consequently there is a build up. No fresh compound is being added and the solution gets out of balance if rested too long.

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**The** most effective baffling of a tank has to be worked out for the particular set of conditions. The rate of turn-over of the solution, the size and shape of the tank, the positions of the return line and pump line are among the factors which determine the location and the number of top and bottom baffles.

## The Life of a Solution

**A large** majority of mills use a tank of solution for its "life", dump and make up a fresh solution. The life of a solution varies in most mills from six weeks to six months. An occasional mill will keep a solution for a year or longer. Some operators dump on a pre-set date regardless of performance, no doubt having determined by experience that satisfactory drawing results would likely terminate at such a date.

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**Some** will dump when the die life begins to fall off. Others will dump when the system gets sludged up, even if it still draws quite well.

## Surface Tension as a Criterion

**Certain** physical and chemical measurements are of assistance in determining the life of a solution. Surface tension measurements are useful as control tests, particularly after a solution has been in use for some time. It is possible that such measurements may serve as a criterion as to when to dump before drawing troubles occur. After all, a wire mill is supposed to produce wire at a profit, rather than to compete in a drawing solution longevity contest.

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**Surface** tension measurement is an indirect means of judging the wetting ability of the solution. When the wetting power of a solution is seriously impaired its lubricating action is impaired.

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**In** general, the surface tension of a wire drawing solution increases with age and use. It is not a straight line function, due to the fact that additions of compound reduce it temporarily, and other factors are also involved, such as the composition of the water supply.

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**The** increase in surface tension with subsequent loss in wetting ability is believed to be due to the gradual increase in the total electrolyte, mainly salts which accumulate in the solution. This can be demonstrated by adding salts to a fresh drawing solution. The accumulated salts are derived from the water supply unless distilled or de-mineralized water is used, and from carbonates formed by carbon dioxide from the air acting upon the alkali from the soap. In cases where salt accumulation is pronounced, primarily due to a relatively high salt content (sodium bicarbonate) in the softened water supply, the surface tension will rise more rapidly and a condition may be reached where the soap is partially "salted out" of solution.

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**Depending** upon the type of compound and water supply used, the surface tension of a fresh solution may range from 30 to 34 dynes per centimeter. Few drawing solutions which have surface tensions of over 40 dynes do a satisfactory job of lubricating.

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**The** time required for a drawing solution to reach a surface tension of 40 dynes may be from two or three months to years, depending upon conditions, such as the rate of water evaporation, as well as the salt content of the make-up water.

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**Total** titratable alkalinity also rises with age and use. Again, this is due to the salts which are introduced or are formed. The soap is, of course, also titratable, but when the solution has accumulated considerable of the alkaline salts it is erroneous to calculate the total alkalinity in terms of soap content.


**Summary**

**Recommended practices in controlling drawing solution are:**

1. **Properly make up the solution.**
2. **Check the strength by means of the Babcock test and maintain the strength.**
3. **Control the operating temperature.**
4. **Check the pH and maintain in the proper range.**

**Surface tension measurements of the drawing solution serve as a criterion for discarding a used solution.**


**References**


1. **Wire Drawing Lubricant Circulating System**
   **Robert C. Williams**
   **Wire & Wire Products Vol 16, P. 699,** *1941*
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2. **The Behavior and Control of Wet Wire Drawing Lubricants for Copper.**
   **Robert C. Williams**
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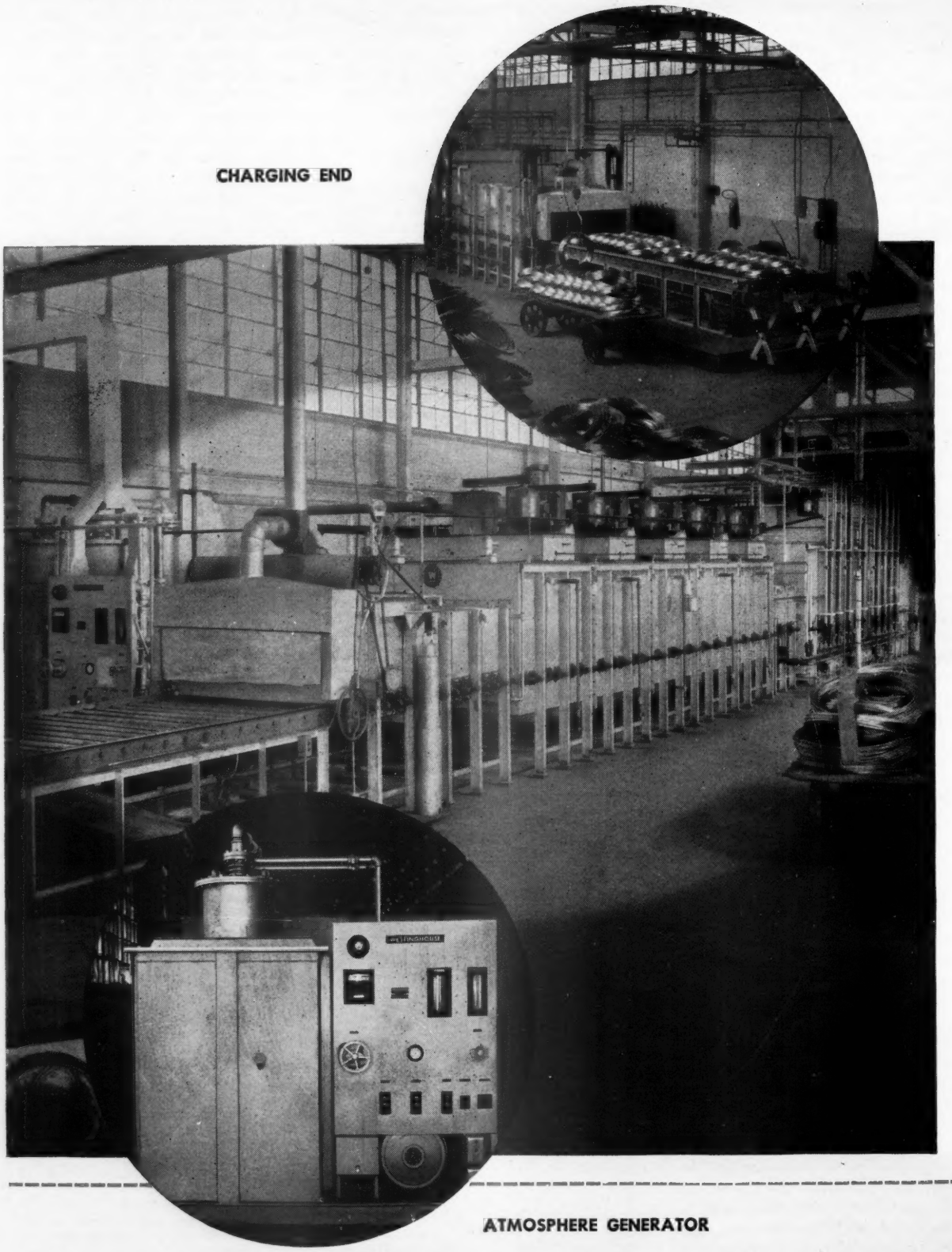

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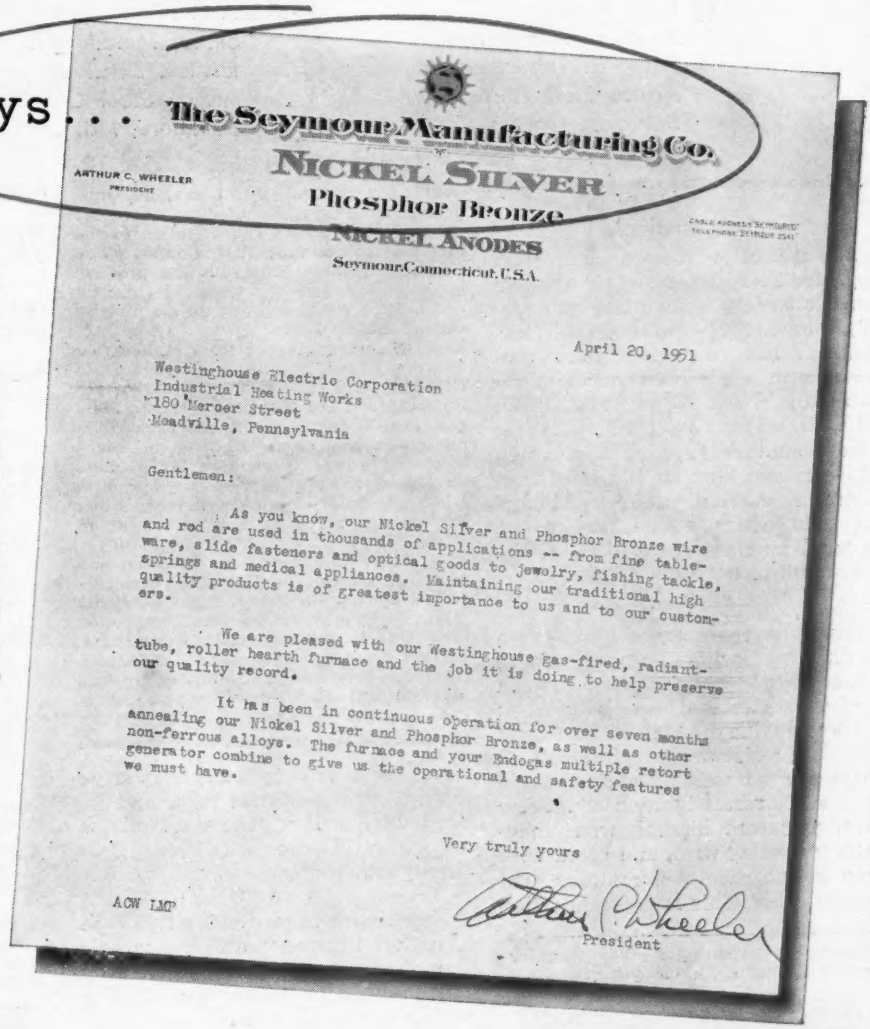

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April 20, 1951

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# SELECTION AND PROCESSING OF CHROMIUM-NICKEL STAINLESS STEELS FOR MAGNETIC APPLICATIONS

By F. K. Bloom
Research Metallurgist
Research Laboratories
Armco Steel Corporation
Baltimore, Md.

and J. S. White
Senior Metallurgist
Rustless Division
Armco Steel Corporation
Baltimore, Md.

**In this paper delivered in Cleveland, Ohio, before the Wire Association on November 11, 1952, the authors call attention to the fact that chromium-nickel stainless steels requiring magnet properties are growing in use. They give the effect of chemical composition and processing on the properties of these steels.**

**F. K. Bloom graduated from Washington University in 1935 with a B.S. degree in chemistry and entered the employ of the Rustless Iron and Steel Corporation, Metallurgical Department. He has engaged in numerous projects related to improvements in processing methods for stainless steel and in the development of new alloys. He holds a number of patents and has written many articles pertaining to this field.**

**J. S. White graduated from Franklin and Marshall College in 1929 and was employed by the Pittsburgh Steel Company in the physical testing and inspection divisions for the Metallurgical Department. He subsequently went with the Armco Steel Corporation in Baltimore, in the Metallurgical Department, where he is now a senior metallurgist.**

## Introduction

**The** use of stainless steel in wire form for corrosion-resisting applications is widely known and processing methods are well established. Watkins has described these procedures in a previous article published by WIRE AND WIRE PRODUCTS. (1)* This present article covers another field of application which is less familiar but is of considerable current interest. This is the field which makes use of the unusual magnetic properties of the chromium-nickel type alloys.

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**Over** the years there has been a steadily increasing number of places where these properties have been used to advantage, especially when combined with the high strength and corrosion resistance which the alloys possess. Examples of such applications are aircraft ignition conductor wire, armature binding wire, magnetic recording wire, and braid wire used in the sheath of military field carrier cable. This latter application alone promises to consume large quantities of stainless wire and its production will require the facilities of many of the wire redrawers throughout the country.

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**Experience** in processing this type of material has shown that magnetic properties are greatly affected by the analyses of alloys, the drafting practice, and by other variables in processing. A brief review of current knowledge regarding these factors, therefore, should be of interest to those wire redrawers who now find themselves handling this product.

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## Definition of Magnetic Properties

**Most** of us, including the authors, would prefer to leave discussions of magnetic properties to the physicist experienced in this rather specialized field. However, if we are to process wire to certain definite magnetic properties it is at least helpful to have a speaking acquaintance with their meaning. The writers, with due apologies to the physicists, will, therefore, attempt to present a brief and approximate description of the principal magnetic properties of interest in stainless.

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**Permeability—$\mu$—expresses the ability of a material to increase the strength of the magnetic field in which it is placed. Strongly magnetic materials have high permeabilities. Weakly magnetic or "non-magnetic" materials may approach the permeability of air which is taken as unity. It is the ratio of (B) the resulting field to (H) the applied field. Permeability varies with the applied field and should be specified as a value at some specific field strength.**

**Residual Induction—$B_r$—expresses the degree of magnetism left in a material after it has been magnetized and the field then reduced to zero. It varies with the strength of the original applied field. Good permanent magnets have high residual induction and coercive force.**

**Coercive Force—$H_c$—When a material has been magnetized this retained magnetism can be removed by placing it in a field of opposite polarity. This quantity expresses the amount of reverse field that must be applied to demagnetize it or its resistance to demagnetization. It also varies with the strength of the original magnetizing field.**

* **Figures in parentheses refer to references appended to the paper.**

F. K. Bloom ★ ★ ★ ★ ★

J. S. White ★ ★ ★ ★ ★

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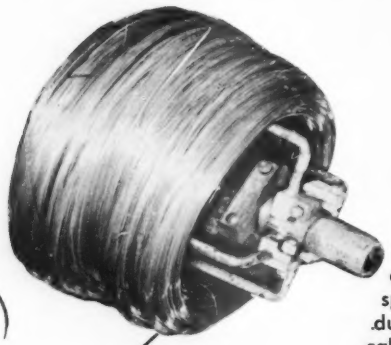
# Problem...

## DESIGNING AND BUILDING A COMPLETE WIRE GALVANIZING SYSTEM . . .



For galvanizing wire, Wean Equipment designed and built the first packaged line ever installed at one time.

Wire machinery in the past always just seemed to accumulate, and be merged into a line that would produce the type and kind of wire desired. Many wire concerns pieced together complete lines, oftentimes fabricating the machinery in their own shops. This is because there was very little coordinated engineering in the field. There was actually no place to go to purchase an entire line from a single source.

Wean Equipment Corporation had established a high reputation for designing and building special machinery for the metals working industries. Complete lines that would automatically perform difficult operations were Wean's strong suit. With this in mind the Colorado Fuel and Iron Corporation asked Wean to design and develop a complete wire galvanizing line to be installed in their Minnequa works.

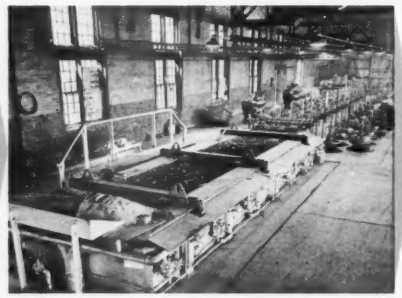
# Solution...

## PACKAGED LINE THAT PRODUCED BETTER WIRE AT RECORD SPEEDS . . .

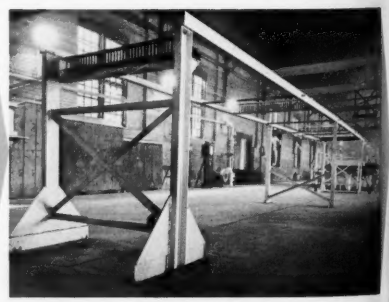
Wean had been experimenting with automatic wire machinery and had assembled perhaps the largest library of wire machinery information held by one company. By drawing on this knowledge it was only a matter of months until the first completely packaged wire galvanizing line was being installed. Today the line is capable of applying a quality coating at a speed of three miles per minute. For all practical purposes there has been no maintenance.

The line is something of a composite of the best features found in studying lines assembled by several leading wire producers. Thirty-six strands of wire are galvanized simultaneously. Each strand has a tandem payoff reel. When one reel has reached the payoff point an operator merely twists the lead of the coil on the second reel to the end of the coil on the first reel and continuous operation is maintained. The wire is acid pickled. It is then water rinsed

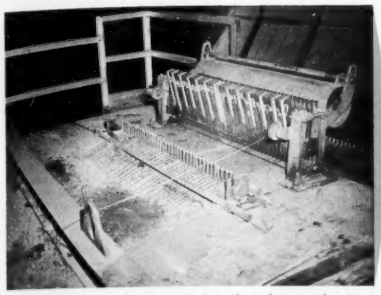
1. **Plain wire leaves payoff reels.** Note the two reels for each strand of wire. It immediately enters the . . .



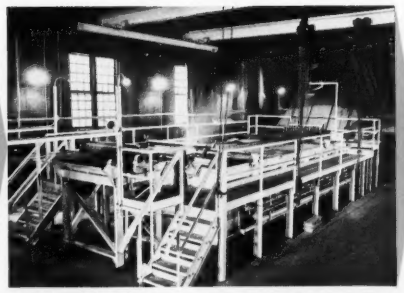
2. **Lead annealing box** where drawing compounds are burned off. It then goes onto a . . .



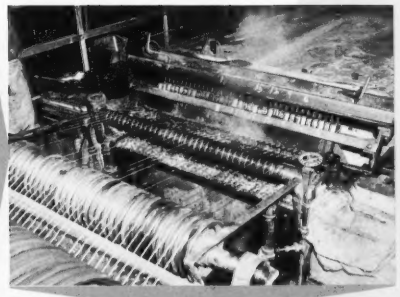
3. **Cooling rack** where wire is air cooled, and into a . . .



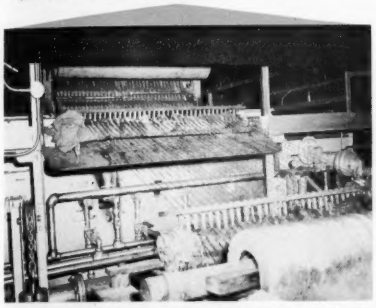
7. **Splice caller,** a unique device that detects the temporary splice, warning operator, then into the . . .



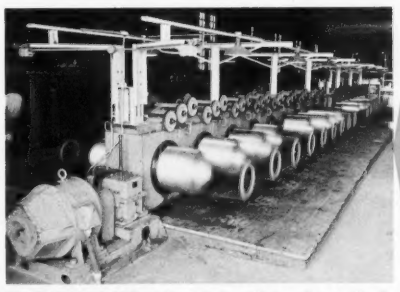
8. **Galvanizing furnace** where zinc coating is applied. The wire then goes through an . . .



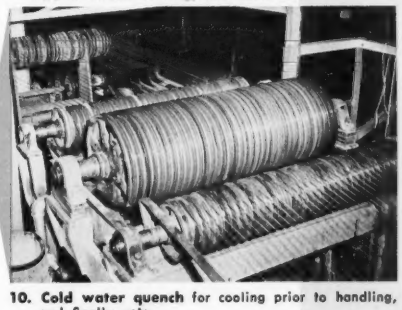
9. **Asbestos wipe** where excess zinc is removed, giving wire a uniform coating, and then into a . . .



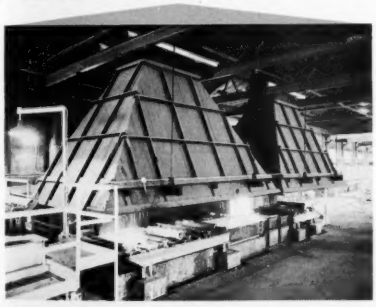
6. **Flux tank** where flux is applied preventing oxidation prior to galvanizing, then through the . . .



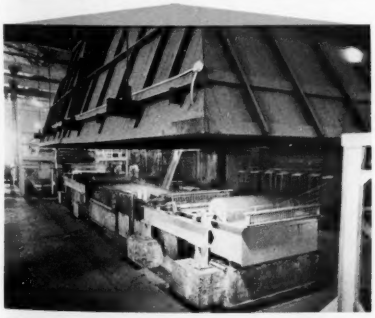
11. **Take-up blocks** where it is coiled and periodically removed.



10. **Cold water quench** for cooling prior to handling, and finally onto . . .



5. **Acid pickle** to clean off remaining scale. It then goes through a second water rinse before entering . . .



4. **Water rinse** for complete cooling. Wire then enters . . .

and sent through a zinc bath where it becomes coated. It then runs through an asbestos wipe where excess zinc is removed. At this point a warning system lets the operator know when the rough union (where the coils were attached) is about to come through the wipe. The operator merely lifts the wipe allowing the joint to pass, drops the wipe and the wire continues over a drying rack, and finally onto the take-up spindles.

The take-up spindles are constructed in a manner that perfectly recoils the wire at high speeds, but still allows a collector to unfasten the rough joint and take each original coil off separately.

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# 4000 FEET PER MINUTE

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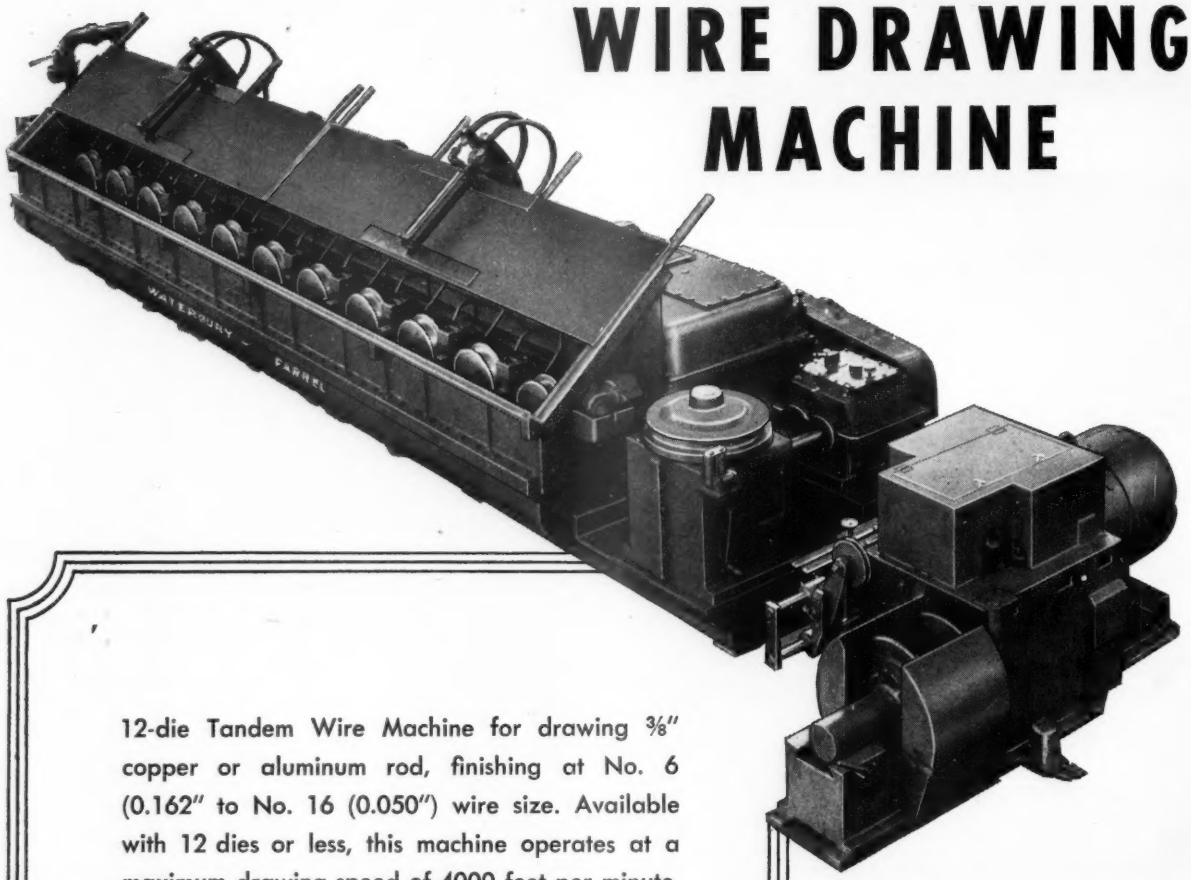


12-die Tandem Wire Machine for drawing 3/8" copper or aluminum rod, finishing at No. 6 (0.162" to No. 16 (0.050") wire size. Available with 12 dies or less, this machine operates at a maximum drawing speed of 4000 feet per minute.

It can be furnished for drawing on spools, or coils, or as a combination machine for both as shown.

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## Classes of Stainless Steel

**Stainless steels** are broadly divided into two groups: A—the plain chromium alloys containing roughly 10 to 30% chromium, and B—the chromium-nickel alloys containing about 16 to 26% chromium and 6 to 22% nickel. The first class of alloys are strongly magnetic (ferromagnetic) in all conditions. These materials enjoy some limited use in magnetic applications but are not considered here. The second group of alloys are substantially non-magnetic (paramagnetic to be exact) when they are in the annealed or softened condition but may or may not become strongly magnetic when cold worked, depending on their chemical composition. It is this group of alloys that are of principal interest.

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**The** chromium-nickel alloys are relatively soft when annealed and will normally have a magnetic permeability in this condition of about 1.005 (air equals 1.00). This permeability will not vary appreciably over the range of test field strengths from 10 to 200 oersteds. Annealed wire will show no response to a strong hand magnet. These alloys, however, strengthen or harden rapidly when cold worked, and some types may become highly magnetic. Some of them are used in applications requiring high tensile strength such as for spring wire or aircraft cables. In some instances it is desirable that despite heavy cold working, they do not become magnetic. This situation applies, for instance, to certain cold headed pro-

TABLE I

Effect of Cold Reduction on Magnetic Permeability

Annealed wire .298" ϕ drawn in single passes at low speeds

| AISI Type No. | Composition C | Mn | Cr | Ni | Others | Magnetic Permeability* after Cold Drawing: Annealed | 10% | 20% | 40% | 70% |
|---|---|---|---|---|---|---|---|---|---|---|
| 301 | .11 | 1.86 | 17.15 | 7.41 | - | 1.010 | 1.96 | 6.64 | 21.3 | 40.0 |
| 302 | .09 | .46 | 18.30 | 8.34 | - | 1.007 | 1.18 | 3.11 | 12.3 | 36.6 |
| 304 | .06 | .58 | 18.46 | 10.18 | - | 1.004 | 1.006 | 1.092 | 1.36 | 2.93 |
| 316 | .06 | 1.82 | 17.32 | 12.54 | Mo 2.30 | 1.003 | 1.004 | 1.004 | 1.005 | 1.009 |
| 310 | .13 | 2.09 | 27.46 | 21.46 | - | 1.005 | 1.004 | 1.004 | 1.004 | 1.007 |

*Measured at a field strength H = 100 oersteds.

TABLE II

Effect of Cold Reduction on Magnetic Residual Induction and Coercive Force

| % Cold Reduction | Type 302 C-.05 Mn-.63 Cr-18.55 Ni-8.80: Residual Induction* Gausses | Coercive Force* Oersteds | Type 304 C-.05 Mn-.58 Cr-18.61 Ni-10.59: Residual Induction* Gausses | Coercive Force* Oersteds |
|---|---|---|---|---|
| 70 | 3650 | 80 | 100 | 275 |
| 80 | 4600 | 60 | 1000 | 230 |
| 90 | 5700 | 45 | 2200 | 190 |
| 95 | 6100 | 40 | 3000 | 170 |

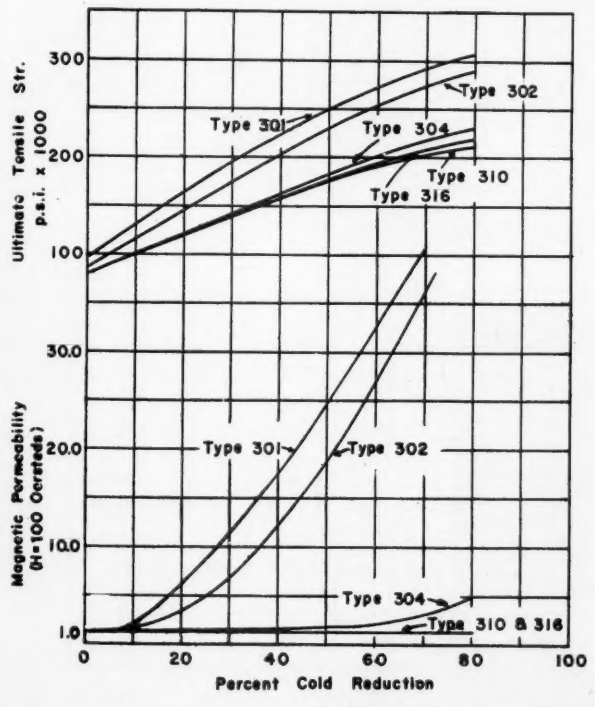


Figure 1, Effect of Cold Reduction on Magnetic Permeability and Tensile Strength.

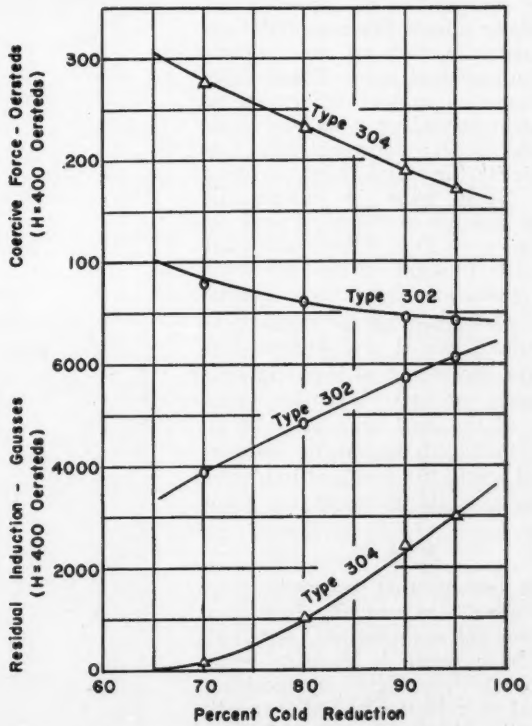


Figure 2. Effect of Cold Reduction on Residual Induction and Coercive Force.

ducts such as instrument panel screws, which must have low magnetic permeability even after the severe cold work involved in upsetting. In other applications such as for magnetic recording, it is desirable to have the wire strongly magnetic and to possess high tensile strength. The correct selection of the best grade for the job depends on a knowledge of the change in magnetic properties with composition and the amount of cold work.

## Effect of Analyses and Cold Work

**Investigation** has shown that the rate with which these alloys become magnetic with cold work is strongly dependent on their chromium, nickel, and carbon contents and, to a lesser extent, on manganese and other elements. Some idea of the range of magnetic permeability achieved by varying amounts of cold reduction in different alloys can be gained from Table I and Figure 1. Figure 1 also shows how the tensile strength of these same alloys varies with cold reduction. As a general rule, alloys with the lowest chromium and nickel contents become magnetic most rapidly with cold work and also increase in tensile strength at the greatest rate.

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**The** composition of the wire also materially affects the coercivity and residual induction of cold drawn chromium-nickel wire. These properties are of major importance in magnetic recording wire and must be held within comparatively narrow limits for satisfactory performance. Such wire is customarily drawn through extremely heavy reductions over 90%. Alloys which are normally thought of as non-magnetic, therefore, may become relatively strong permanent magnets as a result. Table II and Figure 2 illustrate the effect of varying cold reduction on two chromium-nickel alloys of the 18-8 type. It is of interest that with increasing severity of cold work, the residual induction increases while the coercive force drops.

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**It is** evident that magnetic properties are rather critically dependent on chemical composition. Attempts have been made to develop equations which relate composition, amount of cold work, and magnetic properties. [2] [3] However, from a practical standpoint it still remains pretty much a matter of cut-and-try methods to find the best composition to obtain some particular set of properties. The data presented serve to show the trend of magnetic values and the importance of variations in composition and cold work.

## Effect of Processing Variables

**Part** of the difficulty in relating these factors is the fact that processing methods can also affect magnetic

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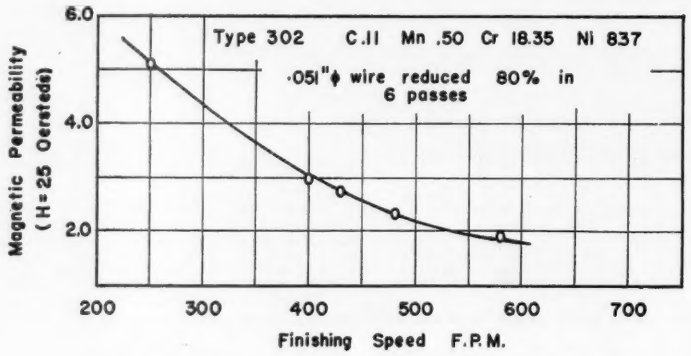


**Figure 3. Effect of Drawing Speed on Magnetic Permeability.**

TABLE III

Effect of Drawing Speed on Residual Induction and Coercive Force

Wire drawn from .016" diameter to .004" diameter, 93.5% reduction in 13 passes.

Type 302 C-.06 Mn-.91 Cr-18.39 Ni-9.41

| Drawing Speed ft. per min | Residual Induction* Gausses | Coercive Force* Oersteds |
|---|---|---|
| 50 | 7850 | 70 |
| 100 | 7700 | 90 |
| 300 | 5450 | 160 |
| 400 | 5180 | 160 |
| 1000 | 4000 | 170 |
| 2000 | 4250 | 155 |
| 3000 | 4250 | 160 |

*Magnetizing field strength not given.

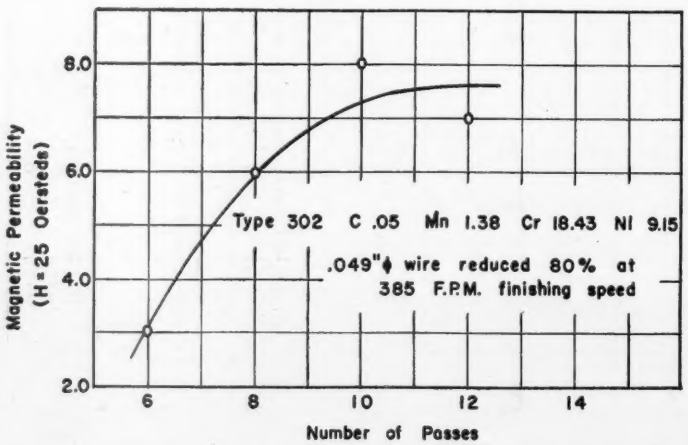


**Figure 4. Effect of Number of Passes on Magnetic Permeability.**

# The Development of Improved Electrical Wiring Materials

by Vincent McBride, Chief Engineer
Plastic Wire and Cable Corporation
Jewett City, Connecticut

**The author graduated in 1932 from the Carnegie Institute of Technology with a degree in electrical engineering. During his early years in the wire and cable industry, he was engaged in engineering work. In 1945 he was added to the engineering staff of his present company, of which he has been the chief engineer for the past several years, with most of his attention focused upon the development of new types of wires and cables in which may be utilized some of the newly available materials. His paper delivered at the Annual Convention of the Wire Association in Cleveland on November 11th, is based, therefore, largely on the experiences of his company in testing and evaluating new wire covering materials.**

**Practical** men in the field at times encounter serious need for improved materials, but, finding no easy solution available, they shrug their shoulders and wait for something better to show up. Sometimes manufacturers are pestered by their customers to make certain improvements in their products which they feel are not practical because of commercial considerations. Then there are occasions when a real improvement is put on the market only to get a cold shoulder from the authorities who think that there are already too many different types available. Let us consider the example of a wiring development that was involved in all of these phases.

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**Over** 15 years ago it became apparent that the standard "BX" and "Romex" cable constructions were not sufficiently serviceable for buildings housing livestock in localities where the winters were severe and the buildings were closed to keep them warm. In the average dairy barn, housing forty cows, about 80 gallons of water per day is added to the air in this confined space from the breath of the cows alone. Furthermore, each cow gives off about as much heat as a 1000 watt electrical heating unit.

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**You** probably have been annoyed by the condensation of moisture on the windows of your home during cold weather. The same thing happens on the inside of the cold walls of the dairy barn. However, the humidity in the barn is more like that in a closed bathroom after a long hot shower bath. Consequently, the walls and the wiring in the barn become soaking wet and stay that way throughout the cold weather.

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**Added** to the wet conditions in the buildings housing livestock are the corrosive vapors coming from animal wastes. The sum total of this combination spells trouble for commonly used metals except copper, stainless steel and certain aluminum alloys. The galvanized steel armor on BX cable corrodes badly in such locations thus ruining its electrical and mechanical safety features.

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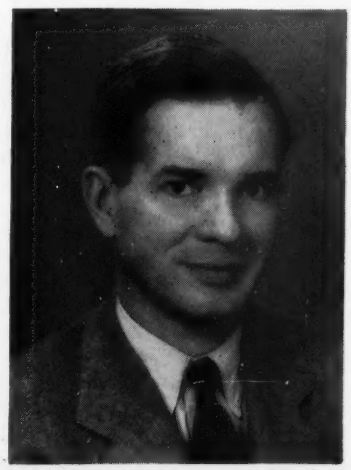
**Organic** fibrous materials such as cotton and paper used as protective coverings in the ordinary Non-Metallic Sheathed Cables disintegrate in as little as a year under these severe conditions. Something decidedly better in the way of wiring materials was needed to prevent serious electrical hazards created in these farm buildings.



Vincent McBride

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**Mr. Glenn Rowell**, the Engineer for the Fire Underwriters' Inspection Bureau in Minneapolis, was vitally concerned with this problem because he was responsible for the electrical safety on the many farms in Minnesota and the Dakotas. He found a possible solution in the use of the special and expensive wiring systems designed for chemical plants. However, he felt that a less expensive and more practical cable could be designed for the purpose. During World War II his search for such a cable had to be set aside for the war effort.

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**After** the war Mr. Rowell tried desperately to interest the cable manufacturers in making a Better Barn Cable. He was advised that such a cable was not worth developing and marketing because it would cost twice as much as the standard Romex and would have only a very limited market.

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**This** Fire Underwriters' Engineer then designed his own Better Barn Cable which could be made of either plastic or Neoprene materials. Finally one cable manufacturer agreed to make such a cable if assured of the sale of at least 100,000 feet. This was done and as soon as samples were displayed farmers signed up for 750,000 feet within a short time.

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At **this** stage of the game the Engineer required that this improved Barn Cable, or its equal, be used in all buildings housing livestock in the area under his jurisdiction to eliminate the serious electrical hazards that were being created in standard wiring materials. Rival manufac-

turers were incensed at this bold step even though it was in the interest of safety. Very serious complications resulted but the crusading Engineer stuck to his guns. Crusades today can cost as dearly as in the days of old when only knights were bold.

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**At long** last the industry was convinced that standard materials were not suitable for the extremely wet and corrosive service conditions. Then competition led to the development of various improved designs. Underwriters' Laboratories approval listing was finally achieved. Consequently, during the past four years over 60,000,000 feet of Better Barn Cables have been sold in the north middle west alone. This at nearly double the price of standard cables. Declared impractical and impossible by the experts this progress was achieved by a man with an ideal and the fight spirit to see it through. Such are the problems of the conscientious man in the field who sees the need for better materials and tries to do something about it.

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**Many** manufacturers seem to prefer the "status quo" which means that standard items can be produced at a minimum cost and with the least trouble. Others, particularly among the smaller manufacturers, see a challenge in combining new materials and improved production techniques to make products better and at lower cost. Typical of such an undertaking was the development of a plastic Barn Cable which has also found many other applications.

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**A completely** new and different approach was chosen in the design of the unique plastic Non-Metallic Sheathed Cable, called "A-Z Cable." The material with the best possible performance at reasonable cost was chosen for each component rather than attempting to improve on the conventional fibrous covered construction. Design was based on the properties of the materials chosen, for ultimately form must follow function.

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**For** the primary insulation over each copper conductor the most economical of space yet most versatile material was the thermoplastic Type TW compound. It has good physical and electrical properties and is suitable for wet locations. This combination of features has within a few years made it a serious rival of the standard rubber Type R insulation which requires additional bulky fibrous coverings.

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**As protection** against damage from stresses imposed by jerking cables during installation the Underwriters' Laboratories required that a Non-Metallic Sheathed Cable lift a 300 pound dead weight and hold it for at least a minute. The tension members selected for this purpose should also complement the Type TW insulation in being highly resistant to moisture, corrosion, flame, and fungus as well as being very strong but as compact as possible. This difficult combination of exceptional properties was ideally met by the use of Fiberglas yarns which were finding rapidly increasing applications in cable construction.

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**After** considerable experimentation to determine the most effective manner to use the Fiberglas yarns it was found that they would serve multiple purposes simultaneously if applied in the form of a helical serving or wrap over the primary insulation on each conductor. In a braided form the maximum strength of the glass fibers could not be realized because under stress or motion they would tend to cut themselves at the cross-overs in the braid. In the serving application the fibers are all parallel. Furthermore, the helical pattern affords an effective elongation somewhat higher than the rather low 4% elongation that is typical of Fiberglas yarn. To prevent the tendency for the two conductor cable assembly to twist under longitudinal stress the serving on one conductor is applied with a left-hand lay and on the other conductor with a right-hand lay which balances the construction.

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**The** layer of Fiberglas yarn sandwiched between the plastic insulation and the enveloping sheath also constitutes a tough reinforcing layer in this laminated construction. This feature contributes substantially to the remarkable performance of this cable under very severe physical conditions while carrying heavy overloads which create internal temperatures as high as 250 degrees Fahrenheit.

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**Still** another feature resulting from this laminated construction is the fact that the sheath could slide on the Fiberglas served conductors thus facilitating the making of neat edgewise bends in the completed cable. The idea of a three conductor parallel cable construction was considered highly impractical until it was demonstrated that the major problems involved could be solved with this new type of construction.

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**To minimize** the possibility of a nail accidently penetrating a Non-Metallic Sheathed Cable and short-circuiting the conductors the Underwriters' Laboratories required that the copper conductors in the cable be separated by at least ⅛ inch. Consequently, the simplest sheath for the plastic cable was one that also formed a web between the two

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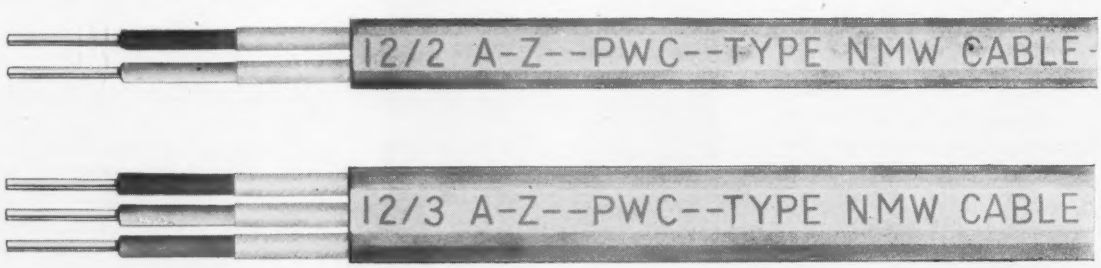

# The Drawing of Weaving Wire

by Albert S. Knapp
Vice President & Chief Engineer
G. F. Wright Steel & Wire Company
Worcester, Massachusetts

**A paper presented at the Annual Convention of the Wire Association in Cleveland, Ohio, on November 11, 1952.**

**Mr. Knapp entered the Engineering Department of American Steel and Wire Company in 1909. He subsequently became head of Wire Weaving at the Wright Wire Company and was an incorporator of the G. F. Wright Steel and Wire Company in 1921.**

**A prolific inventor, he has introduced successions of highly productive equipment into a progressive company.**

**Of the** changes experienced in wire making, none seems more amazing than the abrupt migration from lime to borax with the obsoleting of dryhouses. Many of us are still delinquent in capitalizing on this unexpected legacy of floor space, conjuring some unforeseen objection to abandoning a practice fundamental to this industry since Ichabod Washburn laid its foundation in Worcester in 1831.

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**Developments** over the years have ushered in long sequences of ingenious inventions for supplanting man's skill and brawn by mechanical means, his mental and visual acuity by more delicate and accurate controls.

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**Weaving** wire at our plant is typically .034″ low carbon, drawn ten drafts from the rod in one continuous operation. Power requirements are principally contingent upon area, reduction, speed and tensile, for which an excellent formula is available. This energy is, of course, converted into heat at the rate of 3412 BTU per K. W. hour, and the speed of drawing is very definitely limited to the provisions for its dissipation.

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**In drawing** one ton of low carbon wire, the heat to be radiated at the block will approximate 50,000 BTU, decreasing with the subsequent lighter drafts, but increasing with the tensile that nearly doubles from the rod #14 size. After five more drafts, .034″ tests out at 150,000# tensile, representing a power consumption on the last draft of 25 KW hours per ton and a heat release of 85,000 BTU.

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**A generation** ago when slip machines were in their prime, speeds were restricted to the cumulative effects of this heat between drafts. Practically all weaving wire was then annealed, cleaned, lime coated and baked at #14 size and started down the fine wire machines at only 55.000# breaking strain, with a proportionately lower heat release. No provisions existed for cooling and the cumulative effect of five drafts in rapid succession resulted in smoking and often igniting the cotton waste wound around the wire at the last draft. Eight hundred feet per minute was considered maximum finishing speed for #20 W&M guage, still two or three times the speed of bench drawn wire.

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**Introduction** of means for cooling which delivers wire into the dies of the successive drafts, warm but not hot, plus the benefits of carbide dies and improved metallic soaps, have opened new doorways to faster performances. The choice of coolant is determined by the design of the unit. Where air is employed, the great volume of dust bearing coolant must be effectively sealed off from the lubricating chambers under the block.

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**Finishing** at two thousand feet per minute as is our practice, it is necessary to dissipate 12,000 to 15,000 BTU per hour per draft. With an air supply of 300 CFM or 24 pounds passing over the 3½ square feet internal area of our 12 inch blocks, it becomes obvious that half of this amount is the practical limit of block radiation. Even this represents an air velocity of 3000 feet per minute through the 14 square inches of entrance ports and an elevation of its temperature of 20° F. The balance must be dismissed through aeration of the wire on the storage blocks. The die, which probably absorbs less than 4% of the heat, may still have to radiate 10 BTU per minute and if it be buried beneath an insulating mound of soap, with no provisions for cooling, its life will be shortened from overheating. Water cooling of dies is very messy when the die holder only is cooled and infinitely more so when water circulates around the removable casing.

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**In the** days of belt drives, our grandfathers, with some logic, coined the term "Overhead Expense." Today the investment per wire drawer, including machines, flippers, pointers, M.G. sets and floor space may easily exceed one hundred thousand dollars and though we take down our old shafting, the overhead continues to go up. This makes it imperative to operate equipment at its maximum output, as free as possible from any interruptions of handling, welding, changing dies, bundling, spool removal, repairs and lubrication.

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**Rods** are now welded together, several coils to a boom, preceding cleaning; then transferred by elevating trucks and spotted in position for drawing, eliminating the eternal horsing about and welding by the wire drawer. Arguments against removing welding from under his control are as fallacious as those that have always impeded higher

integration in industry. With centralized welding, the conventional welder is scarcely adequate, due to heat limitations, and a larger unit is being installed in anticipation of extra load from improved handling technique. The common V cut shear is being replaced by a new square cut that permits better alignment at the terminals.

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**We** have learned from the automotive industry the advantages of building machinery with enclosed transmissions; of the use of narrow face gears of improved tooth form, hardened to 58 Rockwell C, precision mounted in oil baths and with plainly visible oil pressure gauges. A few gallons of good SAE 40 takes the place of months of manual Sunday greasing at double pay. All blocks are of Meehanite alloy castings, flame hardened to about 500 Brinnell, which may be returned with difficulty through the use of carbide tools.

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**As the** bundle size increases, so does the debate over fillet radius and the taper. Attempts to use a smaller fillet radius at the drawing point has resulted in disastrous scoring, both on wire drawing and galvanizing blocks. Experiments with tool steel inserts and with cold chromium plating, even with their harder surfaces, have not in general fulfilled hopes for prolonged block life.

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**Time** studies have revealed a seemingly disproportionate amount of a wire drawer's time consumed in bundling coils of finished wire, a requirement necessary for outside shipment but not for wire processed in the plant.

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**350 pound coils** of fine wire are now stripped from 16″ finishing blocks and dropped down onto dead head, or non revolving reels, four to a pallet, and transferred to their destination. Another, and even greater saving is realized through eliminating the cost of opening bundles, where the loosing of ends, the snarling of coils and the making of scrap is an age old headache. Ends are welded together from coil to coil, which could not be done with revolving reels. Coarser sizes, #14 to #17, are finished on 22″ blocks, where a half ton is dropped on the dead head reel.

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**No. 9** chain link fence wire is drawn two drafts continuously on 30″ blocks where enormous dead head stripper reels of 2500 pound capacity, riding on the block, are removed by crane and spotted at the fence machine. Here, considerable benefit is gained from the reduced corkscrewing of the larger diameter coil. Experience has taught the necessity of stripping large bundles before prolonged shut downs and while the wire is still hot.

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**Safety** demands that the height of the wire on the block be limited by a dependable stop motion, capable of being swung aside to accomodate the stripper. With greater speed and larger bundles, block spindles have had to be increased in diameter, provided with larger ball bearings and made from heat treated alloy steels unknown in the wire mill practice of a decade ago.

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**The casting** of wire at the die to prevent making of hay on large coils, requires attention that was scorned in the days when all wire was annealed on spools. The surfaces of the die and die box are carefully machined at right angles to the fulcrum, but the operator continues to wedge the holder out of alignment at some mysterious angle, whose logic defies explanation.

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**Wire cloth** has for years been woven from annealed wire, either from warp beams, as in the textile industry, or from continuous warps composed of spools, either of which requires spooling. Spools are used because it is not economical to set up and serve large areas of 16″ reels where the rate of take off is less than 15 feet per minute. Annealed wire is not economically handled on reels and its cost of spooling is four times that of hard wire. Our practice has been to spool directly on the wire drawing machine, onto 100 pound malleable iron spools which are then annealed, spool and all. Many new evils from inertia and lack of balance have turned up with the expedition of drawing. After a thousand annealings and a decade of abusive handling, cast malleable iron spools do not conduce to smooth spooling at high speeds; and friction take-ups, that do not compensate for change of spool diameter, cause uneven tension.

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**Improved** tension control is being realized through the use of special series wound d.c. motors in which the product of the speed and torque remain nearly constant. This is achieved by introducing a heavy variable resistance in the field circuit which causes a drop in line voltage when the armature's diminishing speed and lower reactance would otherwise admit of too greatly increased current flow. Relatively uniform tensions are thus maintained throughout the spool diameter. All damaged spool heads are now regularly, and effectively, processed in a hydraulic press.

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**To better** realize the advantages of larger coils, we are pioneering in weaving from hard wire by projecting the filling from 350 pound dead head coils at greatly increased speed, and welding the selvages instead of passing two pound shuttle bobbins through the warp in the age old custom of weaving.

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**Developments** in resistance welding are, of course, arousing speculation as to incursion into the weaving field. However, on ½″ mesh standard hardware cloth, there are 57,600 intersections to be welded in a hundred square feet of product whose weaving cost is but a few cents, and on ¼″ mesh there are four times this number. It is even more impractical to undertake this myriad of welding on annealed wire, which is specified for formed products. We are in the travails of developing a broad line of woven products with welded selvages that may be woven at high speeds from wire without the use of shuttles.

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**Good housekeeping** has contributed generously to improved working conditions. A permanent vacuum system was installed in 1939 to remove lime dust from floors, walls and machines without stirring

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# Dry Blending for the Vinyl Extrusion Industry

by M. G. Caine, Assistant Sales Manager
Vinyl Resins Dept., Plastic Division
Monsanto Chemical Company
Springfield, Massachusetts

**In this paper, delivered before the Annual Convention of the Wire Association on November 11, 1952, at Cleveland, Ohio, the author treats of the reasons for blending operations, methods used and late developments that have greatly increased the efficiency of the blended compounds.**

**Mr. Caine holds a B.S. degree in Chemistry from Worcester Polytechnic Institute (1937) and an M.S. degree in chemistry from Brooklyn Polytechnic Institute, earned while employed. His career has been entirely in the plastics field. He joined Monsanto in 1941 as a research chemist. Before getting into the sales end, his efforts were successively devoted to product development and technical service work.**

**In 1951** the estimated amount of vinyl chloride compound used for extrusion was approximately 140 million pounds of which the largest single share was attributed to the wire and cable field. In this high competitive market the new compounding method of dry blending has made substantial inroads and within two years should be the dominant method for the production of extrusion compounds.

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**Practices** generally employed for the compounding of vinyl formulae and subsequent extrusion thereof have all been borrowed from the rubber industry. Conventional banbury and mill rolls used in preparing vinyl compounds were patterned after methods long familiar to rubber compounders. The modern thermoplastic extruder is a simple adaption of rubber extrusion equipment. Today a relatively new compounding technique for preparing vinyl compounds for extrusion is available. This is the dry blend process and this paper is devoted to a description of the various methods of manufacture, formulating, coloring and extrusion practices employed with vinyl dry blends.

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**It may be** well to begin by defining the dry blend process. Dry blending is a compounding technique used in preparing polyvinyl chloride formulae for extrusion in which the solid constituents, resins, fillers, lubricants and stabilizers are mixed with plasticizers and other liquid components in such a manner that a dry, free-flowing, sandy powder of uniform composition results. No further compounding of any kind is required except that provided in the extrusion operation.

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**Historically,** this technique was first applied to vinyls about 1941-1942. But little success was attained until the introduction in 1948 by Monsanto Chemical Company of an improved vinyl chloride resin, Ultron 300. This resin is now known under the trade name of Opalon 300 and is ideally suited to the dry blend process because of the nature of the size and shape of the particle, and its plasticizer absorption characteristics. Monsanto Chemical Company has been instrumental in advancing this compounding method throughout the vinyl industry, and today there is an ever-increasing number of successful dry blend installations.

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**The** dry blend process is attractive because it permits substantial savings in compound costs ranging from 2¢ to 8¢ per pound, depending upon the particular composition, its raw material cost and its selling price. For those processors who do not now manufacture their own compounds and are contemplating doing so, the dry blend process offers the greatest advantages because of the extreme reduction possible in capital requirements for compounding equipment. It also appeals to processors who now possess compounding equipment because of a substantial reduction in operating costs. This economic advantage will result in the savings to the extrusion industry of many millions of dollars per year.

M. G. Caine

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**In dry blending** the vinyl resin permits the absorption of the plasticizer and other liquid constituents so that for practically all elastomeric extrusion formulations a dry powder is formed which can then be blended with the other solid components. In reality, there is a solvating action by the plasticizer on the surface of the resin particle which results in the plasticizer being locked in the particle so tightly that it cannot be wiped or absorbed off. In theory, the operation of making dry blends requires wetting of all the resin surfaces sufficiently rapidly so that uniform distribution takes place before solvation is complete.

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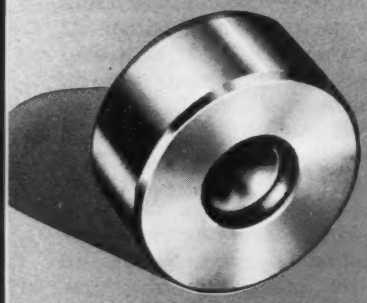
**The** factors affecting the rate and efficiency of the dry blend process are primarily the size and shape of the resin particle, the other ingredients of the formula, and the temperature of operation.

## Advantages of Dry Blending

**The** prime advantage of dry blending is economy. There are

# Why you can expect Top

# Carboloy wire die and



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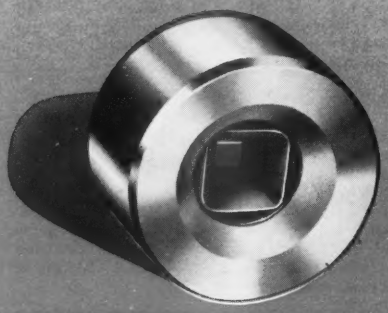

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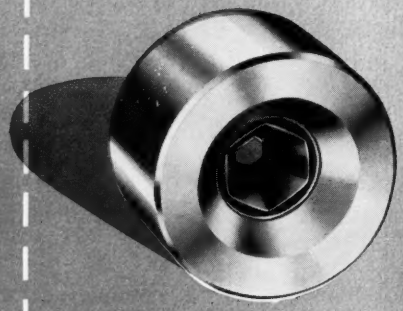

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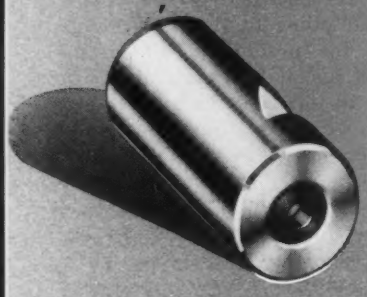

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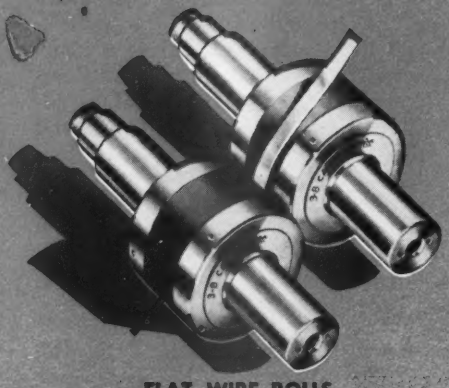
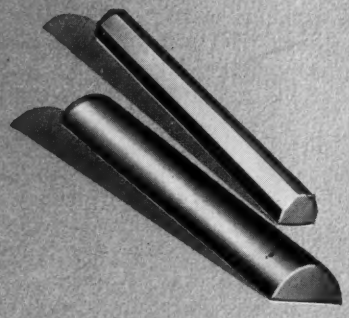
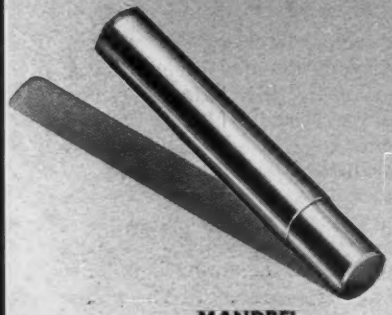


FLAT WIRE ROLLS



SPECIAL-SHAPE DIES



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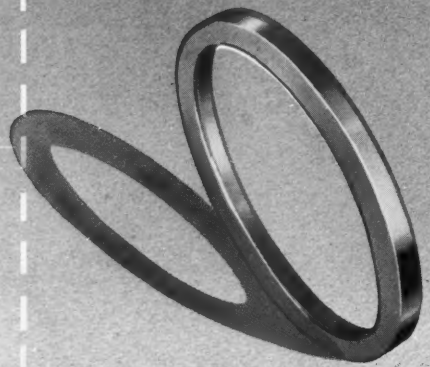
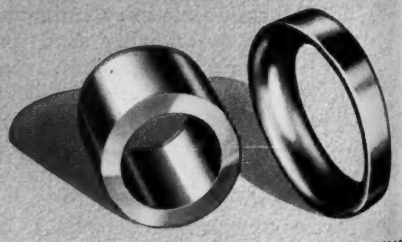


CAPSTAN RING



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Complete stocks of standard dies—ready for immediate shipment—are maintained at Chicago, Detroit, Pittsburgh and Los Angeles. Large, readily available die stocks mean less downtime for your costly machines, die replacements as you need them . . . with lighter die inventories and tighter production schedules.

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other advantages and a complete listing is as follows:

a. Low equipment cost—elimination of conventional heavy compounding equipment.

**A dry** blending operation will require a capital investment ranging from $3500 to $25,000, depending on the size of the operation and the particular technique selected. This compares with $30,000 to $75,000 for mill or banbury mixer costs, depending on the volume of product required. To produce 50,000 lbs. of compound per month on a one-shift, 5 day basis, or over 150,000 lbs. per month on a continuous basis, i is possible to set up a dry blending procedure for as little as $5,000. It is obvious that for these quantities such an operation can be set up for about one-tenth the cost of a conventional granulated compound production unit.

b. Low conversion costs.

**Since** dry blending is simply a refinement of the preliminary mixing step used in any compounding set-up, it is obvious that the total mixing costs are considerably lower than for milling or banburying followed by dicing or granulating in the conventional compounding operation. An efficient dry blending plant should produce finished powder mixes at no more than 1.5¢ per pound complete, including labor, amortization and factory overhead. Some installations are said to be running as low as ½¢ per lb. This compares with the conventional granulated compound costs of between three and five cents per lb.

c. Increased extrusion rates.

**Dry blends** frequently extrude at about 25% faster rates than granulated compounds for a similar extrusion set-up. By taking advantage of improved extruder designs it is possible to increase output to an even greater extent.

d. Minimized heat history.

**Because** of the lower processing temperatures used, dry blends retain much more of the latent heat stability of the compound. This results in better retention of color and better electrical characteristics. The advantage of minimum heat history is also apparent in connection with the reworking of extruded material.

e. Economy and efficiency in materials handling.

**A finished** dry blend is a free-flowing powder which is subject to all of the materials handling techniques adaptable to the powdered resin itself. It can be borne through air conveyors, down chutes under the force of gravity, is readily bagged or drummed for shipment, and can be stored in bins for later transfer by any conventional conveying device. Because of its free-flowing, sandy character, it presents few cleaning problems to conveying or storage equipment.

f. Uniformity of finished product.

**In a** properly made dry blend, the ingredients are homogeneously dispersed. The ease with which the next processing step of colloiding or fusing takes place is a function of the uniformity of the compound. Banburying, milling and extrusion are all faster with dry blends than with crude mixtures.

g. Reduced Inventory.

**Another** important benefit accruing from dry blending is that of reduced inventory. Previously most extruders have had to keep on hand a large stock of various compounds to meet certain requirements. With dry blending a reduced stock can be used to produce the required compounds.

h. Improved flexibility of operation.

**By being** able to prepare any desired compound at a few moment's notice, the extruder is allowed greater flexibility of operation. This is particularly true of special compounds.

## Methods of Dry Blending

**Each** of the several commercial methods available for dry blending has its advantages and limitations. A final selection will depend upon the size and type of operation. However, the principles of operation remain the same regardless of the equipment used. The most common methods employ the ribbon blender or muller-type mixers.

## Ribbon Blender

**The** basic unit in this method of dry blending is a jacketed vessel in which is mounted two spiral ribbons on a central shaft. The ribbon blender, as it is commonly referred to, is adapted from equipment used for mixing in many other industries. The procedure for the manufacture of dry blends in a ribbon blender is as follows:

1. **Resin** is charged to a hot blender and mixed until it reaches a pre-determined temperature.

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2. **All** liquid components such as plasticizer, liquid stabilizers, liquid lubricants, are then sprayed into the blender. The liquid ingredients have been previously charged to a mixing tank and preheated to a pre-determined temperature. A coarse spray is recommended for best results, and in some cases a simple perforated tube will suffice.

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3. **The** dry ingredients, such as fillers and stabilizers, are added to the blender after the resin-plasticizer mix reaches a pre-determined temperature and the blend is substantially dry. The end-point can be demonstrated by the absence of plasticizer spotting of a piece of brown paper when the blend is poured on it. The fillers and particularly the stabilizers may be pre-screened through a 40-mesh screen before charging to the blender.

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4. **Hot mixing** is continued until a stock temperature of at least 100°C is obtained to thoroughly eliminate moisture. An exhaust system should be provided for the purpose of removing any moisture vapor. The steam heating is discontinued and cold water is circulated through the jacket of the blender. When the blend temperature reaches 40°C it is ready for dumping.

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5. **The** completed dry blend is then discharged from the blender and screened through a 20 to 30 mesh screen for packing or further use.

## Operational Notes

**Generally** fifteen pounds of steam will be sufficient but in certain spe-

cial cases steam pressures as high as forty pounds may be required. The actual temperature of the blender jacket will depend on the size of the unit and the nature of the formulation. On the larger units higher steam pressures are used in order to keep the cycle to a minimum.

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**The** exact temperature for the plasticizer input depends on the nature of the plasticizer.

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**The** order of addition of the ingredients as outlined above is extremely important if extensive balling up of fillers is to be avoided. The resin-plasticizer mix must be dry to the paper spotting test before adding the other dry ingredients.

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**Certain** lead salts are difficult to disperse adequately and, hence, must be pre-screened or pre-treated. Pre-dispersion of the stabilizer can be accomplished by grinding the stabilizer and plasticizer on a paint mill or similar equipment. The paste which is so formed can be dried up with resin and then added to the blender.

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**If the** blend is to be used immediately, cooling is not essential. To prevent possible decomposition or caking in the mixture in storage a cooling operation should be employed.

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**The** final screening operations break up or scalp out any objectionable lumps of balled fillers which are usually formed in a blending operation. The percentage of balled fillers which is usually formed with this technique is generally in the order of less than 1 percent but even that 1 percent must be removed if clogging of the extruder screens is to be avoided. The cycle should be determined on the basis of temperature controls and all blenders should be fitted with temperature-recording equipment. The actual time of the cycle will vary with the formulation and the size of the blender. For an average wire insulating compound or profile product in a 500 lb. blender, less than one hour will be required. A 5,000 lb. unit would require close to two and one-half hours with about one-third of this time consumed in the cooling cycle. By providing an external cooling operation such as a cyclone cooler, the overall cycle can be substantially reduced.

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**Figure 1** illustrates a dual ribbon blender installation of 143 cu. ft. capacity each.

**Figure 2** illustrates the interior of the ribbon blender. A ribbon blender having a stainless steel inner shell and ribbons is recommended. The blender should be jacketed for steam. Those capable of handling 75 PSIG give the widest latitude formulation-wise. 15 PSIG steam is generally satisfactory for the bulk of dry blending work. The size of the blender will depend on the quantities to be mixed. Approximately 80% of the capacity of the blender is utilized and a figure of 35 lbs./cu. ft. of blender space is a useful figure in making any calculations.

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**The** blenders are usually fitted with a center bottom discharge valve. It is essential that this discharge valve be so designed that when closed it forms a smooth contour with the inner shell of the blender. If a pocket of resin is allowed to form when the blender is charged this will generally result in unplasticized resin, which will present quality problems on extrusion or subsequent processing operations.

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**The** plasticizer tank should be constructed of stainless steel and may be installed above the blender level to allow for gravity flow to the blender. A mechanical pump is advisable for more efficient handling of plasticizer. The plasticizer may be preheated by steam coils or electric strip heaters and in large installations steam heat exchangers are also useable. A stirrer or high speed portable mixer may be used to keep the plasticizer in continuous movement during preheating. Direct weight recording scales are required, but the plasticizers can be charged by volumetric means rather than on a weight basis.

### Advantages of a ribbon blender

1. **The** original capital cost for equipment is low.
2. **Labor** requirements are at a minimum since one man can operate the equipment completely.

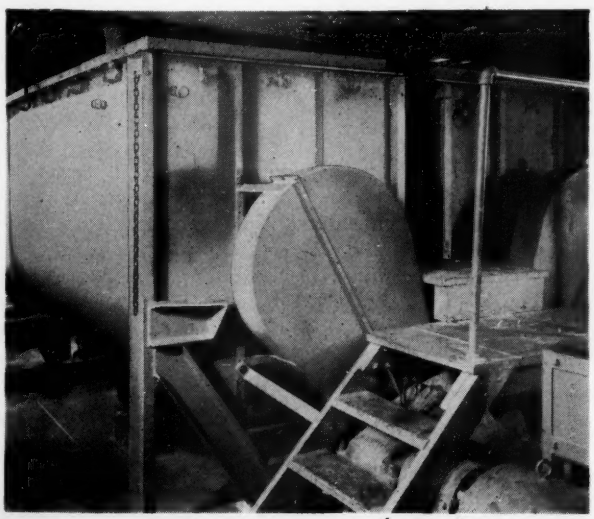

Figure 1

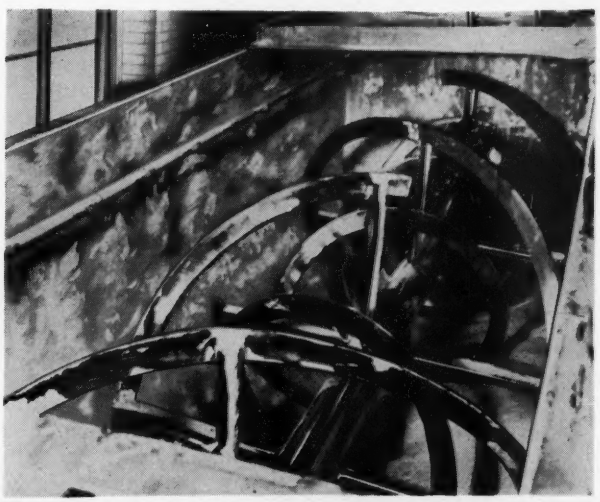

Figure 2

Figure 3

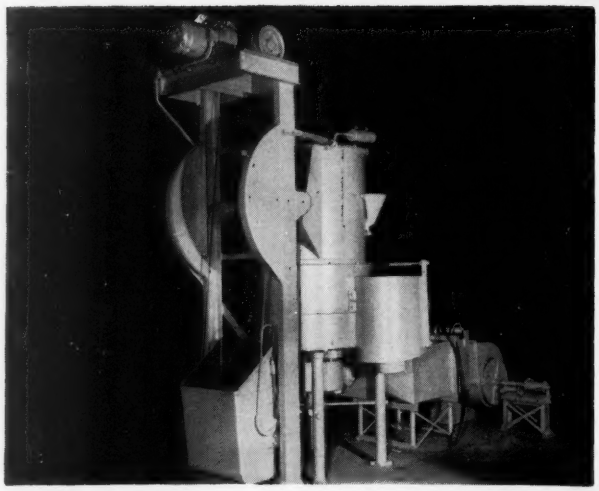

Figure 4

3. **Since** the equipment is simple, maintenance costs are at a minimum.
4. **Equipment** is extremely flexible and cycles or techniques can be varied at will. There is no critical end-point in that once the mix is completed, it may continue to run in the mixer for an indefinite period of time.
5. **Blenders** are available in a wide variety of sizes so that a selection can be made on the basis of batch size and volume of operation.

### Limitations

1. **Large** size blenders are difficult to clean. Small machines do not present this problem.
2. **Care** must be taken to avoid stock build-up on the interior walls of the blender. The interior of the blenders as furnished should be as smooth as is possible to manufacture to minimize the adherence to the blender walls. In some cases it is advisable to have the heating jackets extend only to the level of the ribbons in order to minimize this adherence problem.

### Muller Type Mixer

**Typical** of the muller type of mixer is the "Speedmullor", manufactured by the Beardsley & Piper Division, Pettibone Mullikin Company, which has been adapted to the production of polyvinyl chloride compounds in dry blend form.

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**Pictures** of the "Speedmullor", Figure 3, shows the principle on which it operates. Muller wheels are placed in a horizontal position on a pivot arm and are moved out against the side walls of the bowl by centrifugal force. Material to be mulled is held in the shape of a doughnut around the side of the bowl with the wheels rolling in the center. Figure 4 shows a typical "Speedmullor" installation.

### Procedure

**By comparison** with the ribbon blender method the "Speedmullor" operates on a relatively short cycle. The batch size is approximately 175 lbs. and the length of cycle varies according to the type of formulation to be processed but are a minimum of six minutes. The mixing procedure involves the charging of the powdered resin, stabilizer, pigment and other dry ingredients to the muller equipment by means of a skip hoist. Plasticizers and other liquids are then charged through a pipe to the dry ingredients in the mixing chamber after the agitation has begun. Heated air, normally at a temperature of 375 to 400°F is forced through the mixer by means of a hot air duct. These temperatures may be reached through the use of a boiler handling "Dowtherm" or similar heat transfer media.

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**When** mixing is complete, the discharge door is opened and the muller wheels push the material out into a receiving hopper. The discharge temperature of the dry blend is generally in the order of 200 to 230°F. This temperature will vary with the length of time in the mixer and the temperature of the heated air. The dry blend is generally cooled by the use of an exhaust conveying cooling system. External cooling is the only approach to the cooling problem.

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**The process** is started manually but may progress automatically according to settings on a master control panel. Such factors as the time involved for the operation of the skip hoist, the delay before plasticizer addition, the plasticizer addition rate, actual mixing time and discharge time can all be controlled through appropriate settings of the dials on the master control panel. The cycle may be accelerated through the use of preheated plasticizer.

### Advantages

1. High rate of production.
2. Automatic control of process.
3. Thorough dispersion of ingredients.
4. Intensive mixing action.

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**The** only limitation in the use of the "Speedmullor" is the fact that it is a long run production type of machine and is, therefore, less adaptable to frequent variations in formula.

### Internal Mixers—Beken Mixer

**The** Beken mixer is a steam-heated jacketed vessel in which intermeshing blades rotate around two separate shafts operating at different speeds. Relatively short cycles are used with time varying from ten to twenty-five minutes, depending

upon the formula. The mixer produces a quality product comparable to that made by other methods. The procedure usually adopted in this equipment is to charge all resin, fillers, pigments, stabilizers, etc. to the heated blender and then add plasticizer to the entire mix while the agitation is continued. Figure 5 shows a typical Beken Mixer.

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**The** mixing procedure is flexible in that the order of addition of the raw materials can be varied.

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**Plasticizers** may be preheated prior to addition—a recommended step. External cooling is the only solution to the cooling problem prior to the bagging out of the dry blend. As is the case with all other methods, a final screening operation is suggested to remove any agglomerates of fillers and/or stabilizers that may have formed during the mixing operation.

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**Equipment** is available in various sizes with the 500 lb. batch size being the most common.

### Advantages

1. Equipment is relatively easy to clean.
2. Labor requirements are at a minimum.
3. Maintenance cost is low.

### Limitations

**Equipment** cost for smaller production units is relatively high. This equipment is manufactured by the Bramley Machine Corporation, Edgewater, New Jersey.

## Other Types of Mixers

### 1. Conical Blenders

**In this** method mixing is accomplished by the tumbling action of the blender. Heat is usually applied through a steam-heated jacket surrounding the conical blender. Plasticizer is added through the trunion pulled by a vacuum which is generally applied to the vessel after resin, fillers, pigments, stabilizers, etc. have been charged. As recommended for other dry blending methods, preheated plasticizer is recommended and stabilizers and fillers should be pre-screened or pre-treated as described in a previous section. Moisture is dissipated from the blend by means of a vacuum which helps in reducing the porosity in the extruded product.

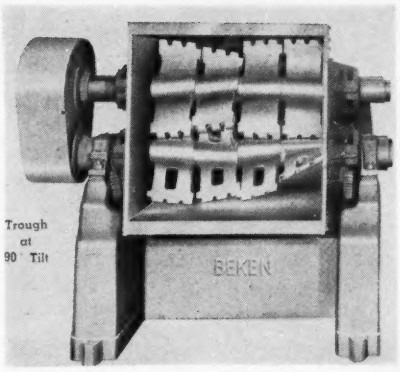


Figure 5

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**Conical** blenders of varying capacities are available and in this respect this system is flexible. Blending cycles are relatively slow; for example: a 500 lb. batch will take approximately one hour. The order of addition of the raw materials cannot be readily varied since this would mean breaking the vacuum and loss in time in regaining it.

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**A final** screening operation and an auxiliary cooling system should be provided.

### Advantages of Conical Blenders

1. A quality dry blend can be produced.
2. Equipment is available in a wide variety of sizes.

### Limitations

1. System lacks positive and intensive mixing action.
2. The order of addition of the ingredients cannot be varied.
3. The equipment is difficult to clean.

### 2. Dough Type Mixers

**Internal** mixers equipped with steam-heated jackets can be used for the production of dry blends, following the same general procedure for mixing as recommended for ribbon blenders.

### Advantages of Dough Type Mixers

1. A quality product can be produced.
2. A variety of types and sizes are available.
3. The operation is flexible in that the order of addition of the various materials can be varied.

### Limitations

1. Capital cost per unit output is usually relatively high.
2. There is inefficient use of the volume of the mixer.

### 3. Hungerford Mixer

**This** is a patented procedure which can be used for the manufacture of dry blends. This mixer is manufactured by the Hungerford Plastics Corporation, Murray Hill, New Jersey.

## Coloring of Dry Blends

**There** are two approaches relative to coloring of dry blends. One is to incorporate the pigment as a powder or a concentrate in the mix itself. The other is to provide auxiliary coloring facilities for adding pigment to completed dry blends.

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**Where** raw pigment or pigment concentrates are added to the mixture itself production runs must be long enough to offset the high clean-out costs. In several installations duplicate equipment has been installed for the production of black compound exclusively in order to minimize clean-out costs and to prevent contamination.

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**There** are three general ways in which the coloring problem can be handled, depending upon the colors involved and equipment available.

1. **Dry** pigments can be blended with a finished natural dry blend in a tumbling blender of some sort, such as a conical blender or a simple tumbling barrel. This procedure is satisfactory with easily dispersed pigments such as white, black and most yellows. In such products as wire insulation, where color requirements may not be as precise as in some consumer goods, many of the standard colors prepared in this manner will be satisfactory.
2. **Pigments** can be predispersed in plasticizer on a roller mill or similar equipment. This system is recommended for pigments which are difficult to disperse adequately by the action of an extruder alone. The paste which is formed in the grinding operation is dried up by mixing it with resin to a crumbly state so that it will disperse in a tumbling barrel.

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3. **The** third method consists of adding granular chips or powdered color concentrates, which are commercially available. Concentrates or master batch granules can be dispersed directly in the dry blend, as would be done with a dry pigment, or they can be tumbled in auxiliary equipment as is also the case with dry pigment.

### Formulating for Dry Blending

**In general,** formulae of polyvinyl chloride will be the same for any end use whether the dry blend process is used or some other mixing procedure is adopted. In the extrusion field, formulae for most types of wire compound, garden hose and practically all miscellaneous profile extruded shapes may be dry blended.

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**In a** break-down of the end uses in the wire and cable field we find that the main applications in the order of their importance from a vinyl usage standpoint are building wire, flexible and portable cords non-metallic sheathed cable, switchboard and appliance wire, automotive wire and Christmas-tree wire. These are all types for which compounds prepared by the dry blend method are generally satisfactory.

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**The** only exceptions where it may not be possible to formulate in the dry blend state are:

1. If the plasticizer to resin ratio is greater than 75 parts per 100 parts of resin and containing no filler.
2. If high viscosity resinous plasticizers, such as Paraplex G-25, are used alone.
3. If solid plasticizers such as Buna N types of rubber are used.
4. If the resin itself is of a type that does not lend itself to the dry blending operation.

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**A blend** containing high plasticizer to resin ratio will tend to be damp and not free-flowing—to eliminate this condition fillers can be efficiently employed. The principle then is to use filler as required if high plasticizer contents are employed.

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**Low** viscosity polymeric plasticizers such as Paraplex G-50 and G-60 will dry blend satisfactorily. Mixtures of polymeric plasticizers with ester-type plasticizers will dry blend satisfactorily.

### Extrusion of Dry Blends

**Extrusion** equipment that will satisfactorily handle dry blends is of prime importance in a successful dry blend operation. With the proper extrusion equipment, it is possible to produce any extruded product from dry blend that is obtainable from granular compound—frequently at higher rates.

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**The art** of extrusion and design of extrusion equipment are subjects about which there has been very little agreement on the part of experts. It is impossible to outline an extruder design or to present a set of conditions which are applicable to all compounds, for all extruded sizes or for all types of extruded products. From experience, certain generalizations can be made which should prove useful in determining the optimum design and conditions for the extrusion of dry blends. The most controversial point in any consideration of extruder machines is the screw design. A careful study of screw design will repay in better extrusion and higher output.

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**While** it is necessary that all the prerequisites for making a satisfactory dry blend be observed, it is highly essential that the various factors affecting the extrusion of dry blends be observed as well. These factors are:

1. Proper ratio of length to diameter of the worm.
2. Compression ratio.
3. Temperature control.
4. Die and breaker plate design.
5. Feeding techniques.

### 1. Ratio of length to diameter

**One** of the most important factors in worm design for the successful handling of dry blends is a ratio of length of worm to diameter. The suggested length to diameter ratio is in the order of 15-20 to 1. The only limits to length are the mechanical limitations of providing a worm with sufficient strength to withstand the rigors of extrusion over a long period of time.

★ ★ ★

**A number** of thermoplastic extruders now in operation do not have this length to diameter ratio. Some of the most recently manufactured extruders are provided with long worms, and this type of equipment generally does a more satisfactory job than some of the older pieces of equipment. Many of the extruders in use today can be modified to provide longer cylinders and worms with resultant increase in output and quality.

### 2. Compression Ratio

**Recent** extrusion trials have indicated that a worm design consisting of a uniform pitch, decreasing depth, having a compression ratio of 3½ - 4½ to 1 is favored. The depth at the head end is shallow by comparison to those suggested for handling granular compounds.

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**No hard** and fast rule can be laid down for the length of the lead, but the values of 1 to 1¾ times the diameter of the cylinder have been used successfully.

★ ★ ★

**A modification** of the above design in which a short metering section of constant depth is maintained for several leads at the head end has proven successful in achieving constant output with better gauge control possible. The worm should be bored for water cooling where such is indicated. Worm clearances of 0.005 inches are suggested. Compression can be obtained by varying the pitch while leaving the depth constant, or by varying both pitch and depth. Indications are that the latter design is preferred.

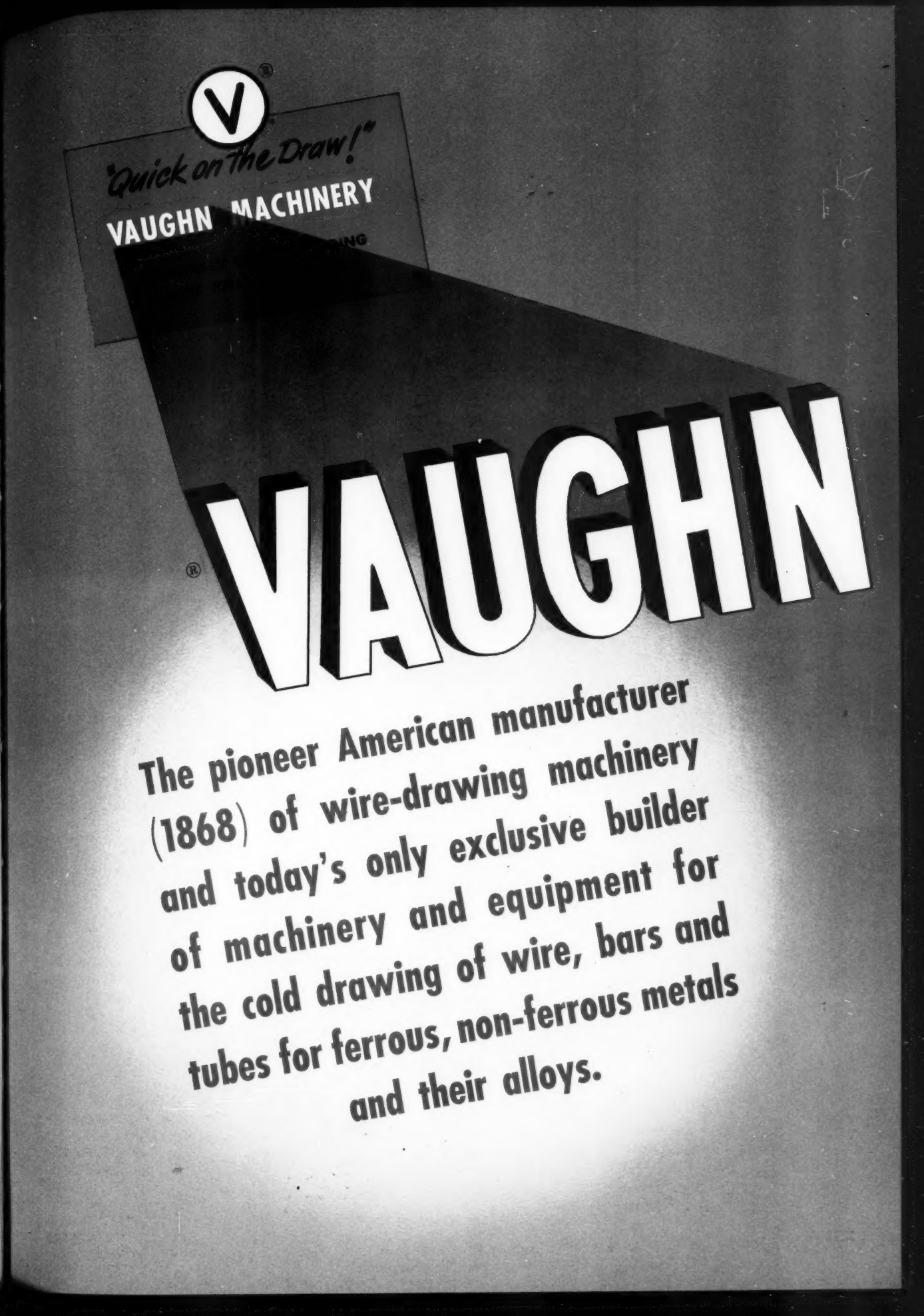
### 3. Temperature control

**In extruding** dry blends, the stock temperature of the compound leaving the die is invariably higher than that found with granular compounds. It is essential that adequate heat controls are provided to maintain uniform temperatures.

★ ★ ★

**Porosity** in the extruded product may be the result of moisture and entrapped air, or both, and this condition, where it exists, increases with stock temperature. With the longer worms recommended the compounding action of the screw will take place further back from the breaker plate, thus permitting more mechanical working of the compound in

(*Please turn to page* 1116)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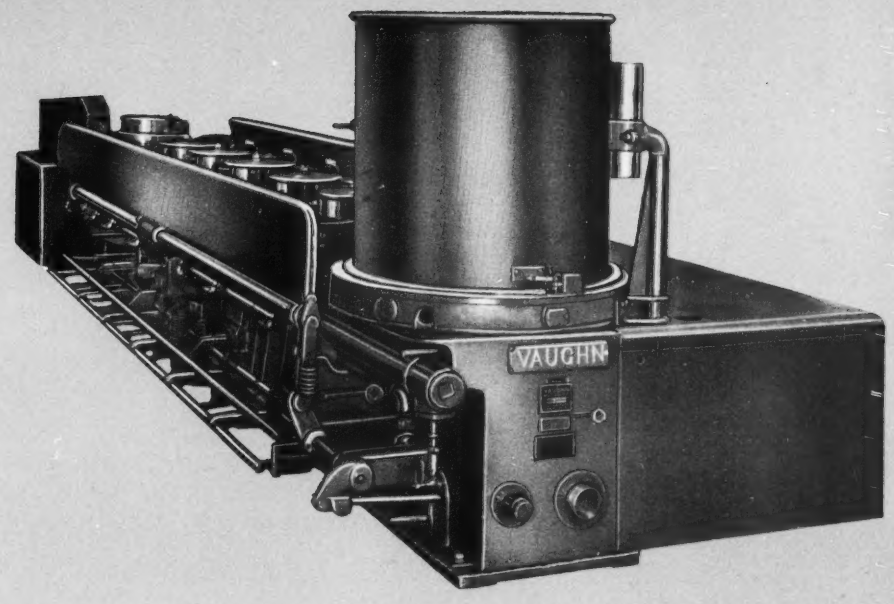


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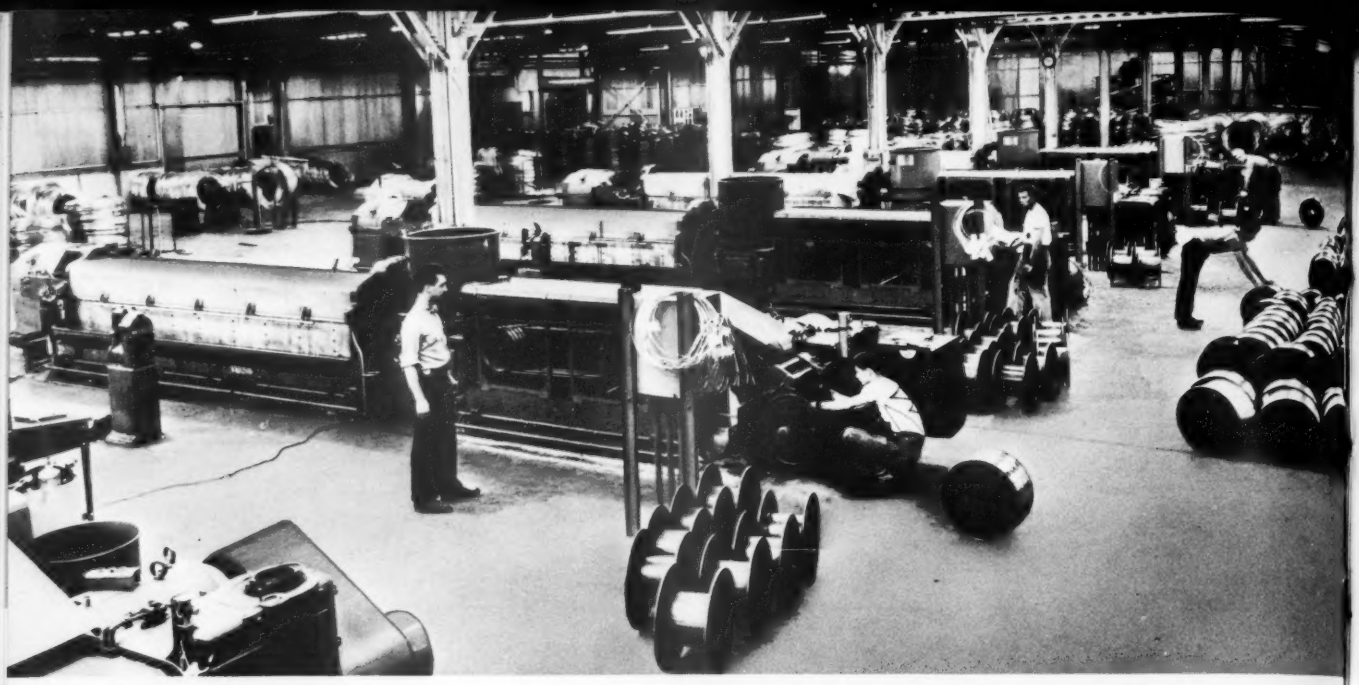

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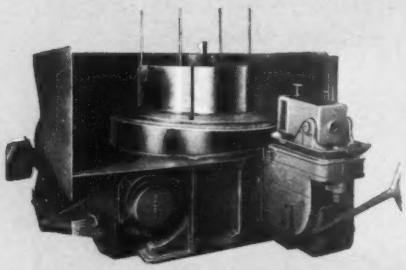

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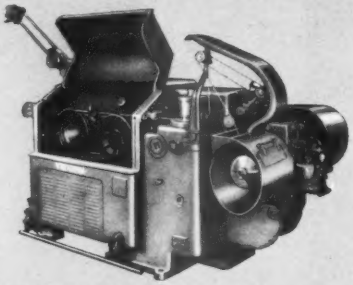

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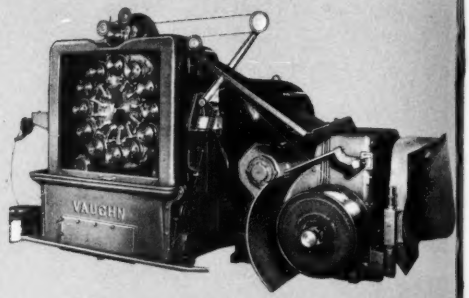


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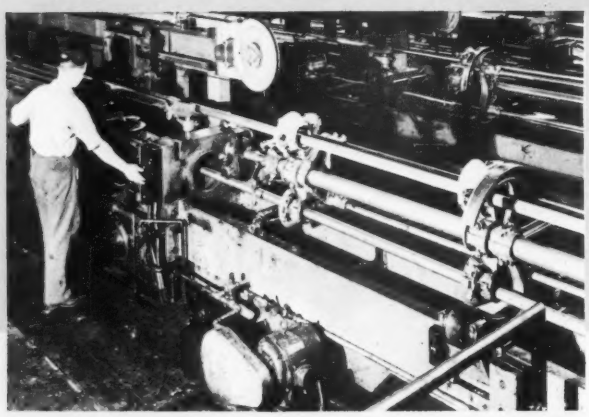

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# WEATHERING CHARACTERISTICS OF POLYVINYL CHLORIDE TYPE PLASTICS

by
J. G. Hendricks and E. L. White
National Lead Company Research Laboratories
Brooklyn, New York

**The growth** and experiences of the vinyl plastics industry continually lead to new knowledge and advances which, in turn, lead to new applications and developments. A pertinent example is the increased use of plastics in applications involving exposure to weather. Film and sheeting for protective covering and outdoor furniture, and extruded products such as garden hose and clothesline, are now well established commercial products. The utilization of polyvinyl chloride type plastics in insulation compounds for electrical conductors for outdoor use is relatively new and of considerable interest at this time. The purpose of this paper is to discuss some of the major factors involved in the formulation of such materials. These factors fall largely into three categories of perhaps equal importance: (1) general considerations in the compounding of vinyl plastics, (2) factors affecting weathering characteristics and (3) evaluation of natural and simulated weathering tests.

**Dr. Hendricks secured a degree of B.S. in Chemical Engineering from Northeastern University in 1943 and an M.S. in Chemistry from the Brooklyn Polytechnic Institute in 1945. From 1940 to 1942 he worked as a rubber chemist at Avon Sole Company and during 1942 as a Research Associate at M. I. T. He joined the National Lead Company's Rubber and Plastics Laboratory staff in 1943, which he heads at the present time. He is the author of a number of papers and holds patents on rubber compounding and vulcanizing and vinyl plastics. This paper is concerned with the compounding of suitable plastic coatings for outdoor use, a recent and growing application of PVC plastics.**
**The co-author of the paper E. L. White, holds a B.S. in Chemistry from Queens College (1942) and an M.S. in Chemistry from the Brooklyn Polytechnic Institute (1952). His fields of activity have included work on natural and synthetic rubbers, vinyl plastics and materials for these products.**

## General Considerations

**The development** of a vinyl plastic compound involves the selection of perhaps six ingredients from hundreds of possible raw materials in numerous combinations and ratios. This apparently formidable task is readily simplified, however, by the restrictions automatically imposed as soon as the end use is specified.

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**The specification** that the plastic is to be used for electrical insulation out of doors immediately introduces a number of criteria for acceptance or rejection of raw materials. Obviously the effect of individual constituents on weathering must be considered. Furthermore, such a product requires a long service life —ten to twenty years or more of continuous exposure. This is far beyond the weathering resistance of normally compounded plastics. Thus optimum weathering resistance is a primary requirement. Insulation is usually manufactured by an extrusion process, as opposed to calendering or coating. The severity of the heat cycle in such a process imposes further requirements, particularly with regard to stabilization. Consequently, basic lead stabilizers are almost invariably used.

J. G. Hendricks

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**Further** drastic screening of all constituents is necessary if high electrical resistance is specified. Plastics derived from paste resins are usually inferior to those from electrical grade calendering and extrusion resins. Rigid (unplasticized) plastics are outstanding electrically, primarily because of the absence of plasticizer. As this infers, use of any plasticizer in normal quantities (roughly one-third of the plastic) substantially decreases resistivity. Diectyl phthalate and tricresyl phosphate are perhaps the least harmful and are widely used in primary insulation. Stabilizers exert a strong influence on electrical properties and selection is almost invariably limited to the lead stabilizers, particularly the basic lead salts. Fillers also are critical. Clay and Lerite improve original electrical properties markedly, most uncoated whitings have little or no effect, while Hi-Sil and some coated whitings may impair electrical properties.

★ ★ ★

**A plastic** to be used out of doors is exposed to wind, solar heat, rain, and extremes of temperature. Plasticizers must have a low rate of volatility to prevent evaporation from the plastic. They must be compatible with the plastic to prevent loss of flexibility due to migration to the surface. Flexibility must be maintained over a range of temperatures, so that the insulation will neither flow at higher temperatures nor become brittle and crack or rupture during winter storms. Paint or lacquer lift may be of importance also, if the wire is to be in contact with a coated surface. Such restric-

tions narrow the choice of plasticizer drastically. Octyl-decyl phthalate and adipate, di-n-octyl phthalate, and perhaps dioctyl azelate and dioctyl sebacate would be suitable selections to fulfill these latter requirements.

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**The factors** discussed above are not unrelated to weathering. Weathering resistance is of little interest if the plastic cannot be processed or if failure occurs from some other causes before the weather resistance of the product reaches the critical stage. Furthermore, these factors necessarily influence formulation to a considerable degree, and the key to weathering resistance is careful selection of raw materials.

## Evaluation of Weathering Resistance

**Vinyl plastics** subjected to natural weathering may exhibit any or all of a number of obvious signs of deterioration, including spotting, discoloration, tackiness, spewing, stiffening and embrittlement. Most of these changes are reflected directly or indirectly in physical and electrical properties. Spewing and discoloration are frequently due, primarily, to the action of light on the plasticizer and may not be too strongly reflected in obvious physical changes. Spotting, stiffening, leading to embrittlement, and tackiness are signs of more fundamental deterioration of the resinous product and must be considered serious in any application. The exposure required to develop these undesirable characteristics varies from a few days to several years, depending on the formulation of the plastic. Each of the constituents of the plastic is critical if a long weathering life is the objective. Particular care must be given the selection of resins, plasticizers, stabilizers and fillers. Of equal importance in the development of suitable compounds is the selection and interpretation of simulated weathering tests, if such are employed.

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**The difficulty** of developing a suitable weather resistant plastic is considerably magnified by the poor correlation between simulated light tests and natural sunlight. This has been recognized by many,[1,2,3] and efforts are under way* to clarify and improve the situation. A valid evaluation of simulated light tests necessarily involves large numbers of tests of many different types of compounds. Such a program is be-

*For example, Group III of the Society of the Plastics Industry and Committee D 20 of the A.S.T.M.

Table I – Comparison of Natural and Simulated Weathering[1]

| | Outdoor Exposure | | | | S4 lamp | | | | Fade-Ometer (175°F) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resin (VYNW) | 200 | | | | 100 | | | | 100 | | | |
| Stabilizer (tin salt) | 5 | | | | 5 | | | | 5 | | | |
| Plasticizer 50 | A | D | B | C | A | D | B | C | A | D | B | C |
| DOP | 55 | 80 | 80 | 100 | - | 60 | - | 100 | 50 | 70 | 85 | 100 |
| TCP | - | 10 | 30 | 125 | - | 20 | 35 | 165 | - | 15 | 25 | 40 |
| 160 | - | 45 | 30 | 60 | - | 30 | 20 | 135 | 90 | - | - | 100 |
| 141 | 60 | 25 | 60 | 105 | - | 85 | 165 | 220 | 190 | 175 | - | 210 |
| 100 equals | 80,000 Langlies | | | | 90 days | | | | 200 hours | | | |

[1] Aaspetting, Dadiscoloration, Destiffening, Cembrittlement.

FIGURE 1

COMPARISON OF WEATHERING OF RUTILE AND ANATASE TITANIUM DIOXIDES IN PLASTICS

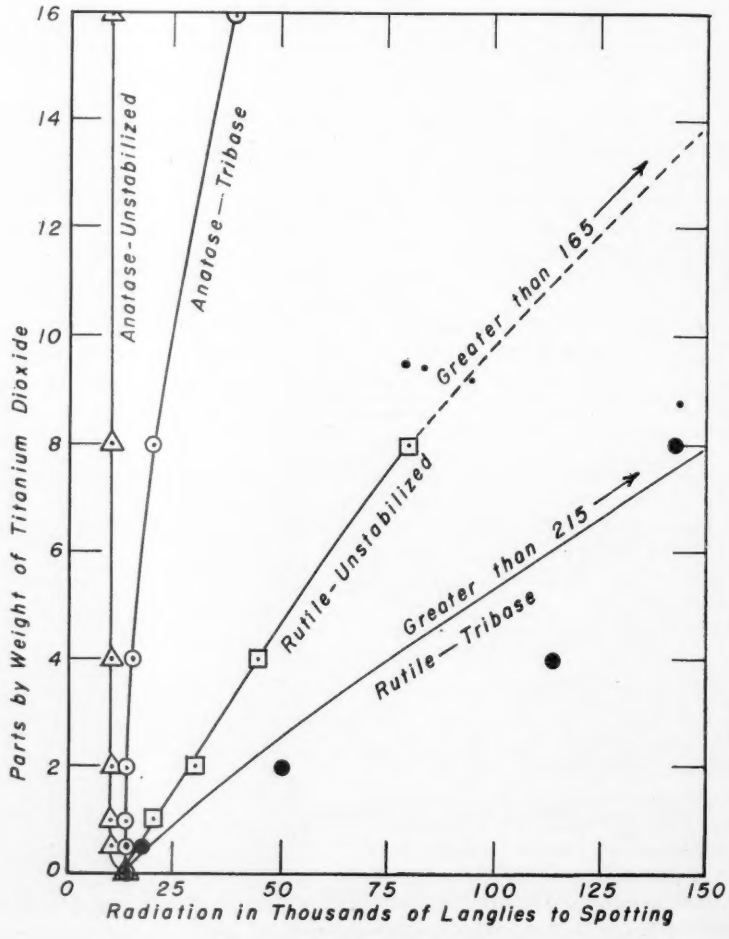

Table II - Effect of Resin Type on Weathering

(In Thousands of Langlies)

| | Homopolymer | Copolymer | Paste | Rigid |
|---|---|---|---|---|
| Resin | Geon 101 100 | VYNW 100 | Geon 121 100 | Geon 404 100 |
| DOP Plasticizer | 50 | 50 | 65 | 0 |
| Stabilizer - 5 | | | | |
| S4 (Sr) | 25 (spotting) | 15 (spotting) | 10 (spotting) | 50 (Discolored) |
| BV5 (Ba) | 40 " | 35 " | 15 " | 50 " |
| JCX (Cd) | 45 " | 35 " | 15 " | 35 " |
| D-22 (Sn) | 65 " | 40 " | 52 " | 40 " |
| Dyphos (Pb) | 190 " | 130 " | > 240 " | > 75 " |

yond the scope of this paper. Table I illustrates a few of the discrepancies that arise, however. In general, two serious handicaps occur frequently in the simulated tests: (1) the order of merit of the samples indicated by simulated tests may differ considerably from that found in sunlight and (2) the type of failure under simulated test may be entirely different from that in sunlight. For example, the Fade-Ometer at 175°F indicates that the TCP stock becomes brittle much more rapidly than is actually the case but indicates better weathering for 160 and 141 than is actually the case. Spotting is a frequent early sign of degradation in natural weathering, but with some test machines, particularly those using lamps, as opposed to carbon arcs, spotting is much less frequent. In the present examples, DOP and 141 spot out of doors, but not in the S4 lamp test.

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**Fundamentally,** the serious differences between machine tests and natural weathering tests are traceable to differences in the absolute and relative ratios of intensities of radiation of different wave lengths as a first approximation. Distance from the arc and operating temperature, in machine tests, have been found to be particularly important.

**The examples** given are more typical than exceptional. At the present time there is no satisfactory commercial simulated weathering machine for vinyl plastics. Considerable research is underway on this problem and considerable information already has been accumulated. Present data indicate that the Fade-Ometer *operated at the lowest possible temperature* gives the most reliable results of the currently available instruments. Actual outdoor weathering tests are required, however, for dependable results.

## Factors Influencing Weathering Procedure

**Unless** otherwise stated, the basic recipe consisted of 100 parts by weight of resin (VYNW or Geon 101), 50 parts of plasticizer (dioctyl phthalate) and 5 parts of stabilizer. The compounds were fused and sheeted at 250°F and 275°F for the copolymer and homopolymer respectively on a two roll, even speed, mill. Paste resin compositions were prepared by first ball milling the stabilizer with plasticizer, blending the ingredients in a kitchen type mixer, deaerating the resulting product in a vacuum dessicator, and finally, fusing draw-down films for 5 minutes at 375°F in an infra-red oven.

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**All light** stability tests were made on 6 mil (0.006″) sheeted film, except for the 70 mil press-polished sheets used for the stress-strain evaluation. Temperatures noted for simulated weathering tests were made with black panel thermometers. Outdoor weathering tests were conducted at Sayville, New York, a semi-rural location at latitude 40.6° on the South Shore of Long Island, on 45° southern exposure fences. Radiation is reported in thousands of langlies*. Radiation at Sayville is approximately about 125,000 langlies per year with roughly 4000-5000 langlies per week with the summer sunlight. The langley is the standard measure of outdoor radiation as used by the U. S. Weather Bureau[4], and includes radiation that does not adversely affect the plastic. The ratio of the intensities of radiation presumed deleterious to points not harmful is not constant from season to season, or under different weather conditions; hence, specimens exposed at different times of the year are not strictly comparable. Some of the data included herein were obtained from specimens exposed at different times; however, where direct comparisons are made, the data are comparable. The use of total radiation as a measure of exposure to weather of plastic samples is considered much more reliable than elapsed time. Further refinement is highly desirable, of course, and it is hoped that data based particularly on the measurement of those portions of the total radiation deleterious to the plastic can be obtained in the near future.

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## Resins

**The effect** of resin selection on the weathering resistance of plastics derived therefrom is less marked than some of the other factors, but is none the less important. Because of the dominating effect of plasticizers and stabilizers on weathering, a variety of conflicting data may be readily obtained. Careful examination of extensive studies on this

Table III - Effect of Plasticizer Type on Weathering

(In Thousands of Langlies)

Geon 101 100, tin salt 5, plasticizer 50.

| Plasticizer Type | Spotting | Discoloration | Stiffening | Embrittlement |
|---|---|---|---|---|
| P4-Unsaturated Ester | 35 | 25 | 20 | 35 |
| SC-Ether Ester | 35 | 35 | 30 | 35 |
| G60-Epoxy Ester | — | — | 30 | 50 |
| TCP-Aryl Phosphate | — | 35 | 30 | 110 |
| 141-Alkaryl Phosphate | 40 | — | 50 | 90 |
| G25-Polyester | 75 | — | — | 110 |
| 160-Alkaryl phthalate | 40 | 20 | 40 | 55 |
| DOP-Alkyl phthalate | 50 | — | — | 95 |
| DOS-Alkyl Sebacate | 75 | — | — | 75 |

*Gram-calories per square centimeter.

Table IV - Effect of Stabilizer Type on Weathering

(In Thousands of Langlies)

VYNW 100, DOP 50, Stabilizer 5.

| Stabilizer - | Type | Spotting | Embrittlement |
|---|---|---|---|
| None | -- | 5[1,2] | 30 |
| 621 | Ca | 25[1,2] | 35 |
| SN | Sr | 15 | 30 |
| G 60 | Epoxy | 20[2] | 55 |
| BWS | Ba | 35[1,2] | 75 |
| 210 | Cd | 35 | 70 |
| Mark XI | Ba-Cd | 20 | 75 |
| Barinac -1.25<br>Stabelan B-2.5<br>RN-34 -1.25 | Ba<br>Cd<br>Epoxy | 35 | 80 |
| Dibutyl tin Maleate | Sn | 65 | 120 |
| Plumb-O-Sil A | Pb | 30 | 70 |
| 201 Silicate | Basic Lead | 45 | 55 |
| Dythal | Basic Lead | 55 | 115 |
| Dyphee | Basic Lead | 130 | 205 |
| Victor 53 | Na | 165 | 240 |

[1]Also becomes tacky during exposure.

[2]Also becomes discolored during exposure.

subject leads to the following general conclusions:

1. **Use of the best light stabilizers (sodium salts, dibasic lead phosphite) greatly minimizes substantial difference in weathering resistance between resin types.**
2. **When poor to good light stabilizers are used, homopolymer resins are usually superior to copolymer resins. There are exceptions to this, especially with certain stabilizers and/or plasticizer systems.**
3. **Paste resins (compounded and prepared according to normal plastisol procedures) require more effective light stabilizers than calendering or extrusion grade resins, to achieve satisfactory light stability.**

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**The paste** resins have a decided tendency to develop severe tackiness. Use of the most effective stabilizers, however, eliminates tack and imparts weathering resistance comparable to that obtained with other resin types. The rigid (unplasticized) resins have a definite tendency to discolor. Calendering and extrusion grade resins may either develop spots or become discolored as the first visual evidence of exposure to light depending upon the plasticizer system.

## Plasticizers

**The choice** of plasticizer (s) is of critical importance. As might be anticipated, the presence of certain chemical groupings in the plasticizer plays a dominant role in the light stability of the final product. Aliphatic unsaturation, ether (or thioether) linkages, the phosphate group, benzyl groups and chlorine groups are generally, but not always, harmful.

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**Plasticizers** containing aliphatic unsaturation or ether groups tend to stiffen and become brittle after very short exposure to light. The traditional stability of the ether linkage in organic chemistry as compared to the ester linkage in organic chemistry, for example, does not apply to peroxidation. It appears probable that unsaturates and ether groups form peroxides which are decomposed by light, leading to free radical reactions.

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**Triaryl phosphates** become extremely stiff and discolored on short exposure, but differ from ethers in that the exposure interval between stiffening and embrittlement is much greater in the case of the phosphates. The trialkyl phosphate light degradation appears to involve a much greater degree of chain scission, in contrast to the crosslinking which dominates in the above cases. Alkaryl phosphates, in further contrast, usually have superior weathering properties.

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**Chlorine - containing** plasticizers usually fail very rapidly on exposure to weather. In contrast to the weathering of ether esters and unsaturates, which is modified only slightly by various stabilizers, very good weathering can be obtained with chlorinated plasticizers provided highly effective stabilizers are used[5]. The problem here is essentially similar to the stabilization of polyvinylchloride resin.

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**Plasticizers** exhibiting better weathering resistance include dialkyl phthalates, such as dioctyl and octyl-decyl phthalates; aliphatic esters, such as dioctyl sebacate; octyldiphenyl phosphate and some, but not all, polyesters. Table III illustrates some of these observations.

Table V - Effect of Fillers on Weathering

(In Thousands of Langlies)

Geon 101 100, DOP 50, Tribase 5, Filler 10

| | Spotting | Discoloration | Stiffening | Embrittlement |
|---|---|---|---|---|
| None | 25 | 55 | -- | 85 |
| Rutile Titanium Dioxide (RA) | 140 | -- | > 185 | > 185 |
| Anatase Titanium Dioxide (ALC) | 20 | 110 | | 135 |
| Atomite Whiting | 25 | 55 | 50 | 100 |
| #33 Clay | 15 | 45 | 50 | 70 |
| Hi Sil | 15 | 10 | 15 | 65 |
| Silene EF | 15 | 30 | 35 | 90 |

## Stabilizers

**The selection** of stabilizers is most critical[1], although relatively simple where weathering resistance is of

prime importance. Table IV compares the weathering of various types of stabilizers in a DOP-VYNW base, and illustrates their relative effectiveness.

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**Unstabilized** compounds, barium and calcium ricinoleates and epoxy stabilized compounds, usually develop tackiness and discolor on exposure to sunlight, possibly because of their unsaturation. Generally, the calcium, barium, strentium, epoxy, cadmium, barium-cadmium, barium-cadmium-epoxy, normal and basic lead stabilizers offer at best only very moderate protection against weathering. Serious indications of degradation or even complete degradation usually occurs in such unpigmented stocks within two summer months. Tin stabilizers commonly offer above average light resistance, but are not considered adequate where exceptional performance is necessary. Only Dyphos (dibasic lead phosphite) and most of the sodium stabilizers are capable of imparting the degree of weathering resistance required for extended outdoor exposure.

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**The overall** problem involves stringent processing, heat stability and electrical requirements. Dyphos excels in all of these qualities whereas the sodium stabilizers are deficient.

## Fillers

**The general impression** in the industry is that fillers aid light stability. This is partially correct as shown in Table V. For the most part, fillers are relatively innocuous as far as light stability is concerned, although there is an obvious dependence on the plasticizer and stabilizer systems. However, plastics containing clays and some other silicates frequently show degradation earlier than do unfilled plastics. Carbon black and rutile titanium dioxide[6], on the other hand, are unquestionably very beneficial to weathering resistance. Figure 1 compares the effectiveness of rutile and anatase titanium dioxides with and without moderate stabilization. The anatase product is relatively ineffective, whereas the rutile titanium dioxide imparts a substantial degree of light stability (but not heat stability), and this is essentially additive to that supplied by the stabilizers.

## Physical Tests

**The results** described are based primarily on tests conducted on six mil films. Thicker sheeting and extrusion may require longer exposure to reach embrittlement, though in a number of cases, 6, 12 and 24 mil plastics exhibited identical cycles of failure. This observation is attributed to the predominance of surface reaction. In any event, the same fundamental degradation of the plastic is involved, regardless of thickness.

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**The data** are insufficient as yet to attempt a detailed correlation between weathering tests of the type described and physical properties, as measured by stress-strain analyses, of weathered plastics. Evidence to date indicates there is good correlation as shown by comparing Table VI with Table IV. Ultimate tensile strength and elongation both decrease severely with weathering and provide the most useful physical criteria of light degradation. Unfortunately, the modulus, which can be measured much more reliably, does not appear to be a suitable index of weathering action. The modulus increases or decreases very moderately relative to degradation, depending upon the formulation. Indentation hardness follows an interesting pattern. Poorly or unstabilized plastics show an almost immediate sharp drop which is recovered rapidly after which, as for well stabilized stocks, the hardness increases very gradually.

## Conclusions

**Overall** consideration of factors influencing weathering with other practical aspects of processing and compounding polyvinylchloride type plastics selectively narrows the masses of potential raw material to relatively few materials, such as those summarized in Table VII.

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**Polyvinylchloride** homopolymers plasticized with DOP (di-2-ethylhexyl phthalate) is most generally suitable. The DOP might be supplemented with di-n-octyl phthalate or octyl-decyl phthalate or adipate to improve volatility and low temperature flexibility, without undue loss of electrical properties. Carbon black or rutile titanium dioxide are indicated for protective pigmentation. Clay or whiting may be used if desired. Dyphos provides an outstanding combination of heat and light stability with excellent retention of electrical properties. DS-207 provides the necessary lubricity for processing and further aids both heat and light stability.

(*Please turn to page* 1126)

Table VI - Effect of Outdoor Exposure on Physical Properties

| Stabilizer | Exposure (1000 Langlies) | (Wks.) | Tensile Strength (psi) | Elong. (percent) | Modulus M-200% (psi) | Hardness (Shore A) |
|---|---|---|---|---|---|---|
| None | none | 0 | 2350 | 315 | 1950 | 90 |
| | 15 | 2 | 2075 | 260 | 1975 | 81 |
| | 40 | 10 | 1970 | 190 | - | 90 |
| | 65 | 18 | 1640 | 140 | - | 91 |
| 621 | none | 0 | 2550 | 380 | 2000 | 88 |
| | 40 | 10 | 1970 | 205 | 1960 | 91 |
| | 85 | 24 | 1540 | 145 | - | 91 |
| | 115 | 45 | 1320 | 95 | - | 90 |
| Dyphos | none | 0 | 2560 | 370 | 2015 | 89 |
| | 115 | 45 | 2500 | 310 | 2160 | 90 |
| Victor 53 | none | 0 | 2440 | 340 | 1960 | 88 |
| | 115 | 45 | 2060 | 300 | 1910 | 90 |

Table VII - Suggested General Formulation

| | |
|---|---|
| Polyvinylchloride | 100 |
| DOP (di-2-ethylhexyl phthalate) | 40-50 |
| Di-n-octyl phthalate | 10-0 |
| Carbon black or Titanox RAEC | 5-10 |
| SO Clay or Whiting | 0-5 |
| Dyphos | 5-10 |
| DS-207 | 0.3 |

# Creep and Relaxation of High Strength Steel Wires at Room Temperature

by Gordon T. Spare, Research Engineer
American Steel and Wire Division
United States Steel Company
Cleveland, Ohio

**This paper was given before the Annual Convention of the Wire Association in Cleveland, Ohio, on November 12, 1952.** **In it the author shows that nominal amounts of creep and relaxation occur in high strength steel wires subject to high sustained stress or strain. These changes are affected by various treatments given the wire and appear to be specifically related to elongation ductility.**

**In** this paper, we are concerned with an excellent example of a new demand being made on an old material, with the consequent necessity for a sudden expansion of our understanding and definition of properties. As is well known, high strength steel wire in the cold drawn state is not a notably elastic material. Its tensile stress-strain curve begins to show plastic yielding at relatively low stress. This early plastic yielding apparently results from residual stresses left in the wire by the drawing process.

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**Any** circumstance that alters this state of stress is then reflected in the yielding pattern. Differences in the wire drawing practice itself, the amount of curvature or coil set left to be removed before tensile testing, the type and amount of mechanical straightening, the degree and duration of heating during drawing—all these influence the yielding behavior. Post-drawing treatments, such as stretching or stress-relief heat treatments, which alter the state of residual stress in the wire, also have their effects on the manner of yielding.

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**It** has always been sufficient to describe these differences by determining the position of arbitrary locations on the stress-strain curve, in terms of strengths at certain plastic or total strains. Thus, we have had the proof-stress at 0.7 per cent and 1.0 per cent elongations and the 0.1 per cent and 0.2 per cent offset yield strengths, as well as other similar criteria.

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**There** is now, however, a demand among users of wires for prestressing concrete, for a more detailed knowledge of the yielding properties of these wires at high stresses. Specifically, it has become important to know the load-carrying stability of such wires under tensile stresses on the order of 50 to 70 per cent of the tensile strength.

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**There** are two properties which can be studied to measure the differences among wires in this respect. One of them, creep, can be simply defined as the continued stretching of the wire under constant load. The other property, which in these very hard wires is much more difficult to measure, is the progressive relaxation or loss in load with time, at a constant extension. These properties are, of course, closely related. Relaxation on a microstructural scale, within the grains, caused by conversion of elastic to plastic strain, requires the constant addition of elastic strain to maintain any desired load. This gradual increase in strain is then the creep which we are able to measure.

Gordon T. Spare

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**There** has been a limited amount of work by European research workers on this problem. It seemed desirable, however, to determine these properties with respect to wires made with American steel-making and wire-drawing practices. A paper presented by H. J. Godfrey in August, 1951 before the first United States Conference on Prestressed Concrete contained a useful discussion of the manufacture of suitable wires for prestressing. Mr. Godfrey also described the prestressing application in relation to the properties of these wires and presented some creep data.

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**The** present study is concerned with the creep and relaxation properties of two 0.192 inch diameter wires:

| Wire | % C | % Mn | % Si | T.S. | % El. 10" |
|---|---|---|---|---|---|
| A | 0.80 | 0.58 | 0.21 | 250,000 p.s.i. | 2.6 |
| B | 0.80 | 0.56 | 0.20 | 230,000 p.s.i. | 2.9 |

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**It** may be well to preface the description of the creep tests with a brief consideration of the evidence of the familiar tensile test, particularly as to the high rates of plastic strain which prevail during loading.

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**The** stress-strain curve in Figure 1, made with wire "A", demonstrates that large differences in strain rates do not affect the usually measured yielding properties. A strain rate of about .001 in./in./min. may be considered as about the normal rate for recording the ordinary stress-strain properties. A tenfold increase and a tenfold de-

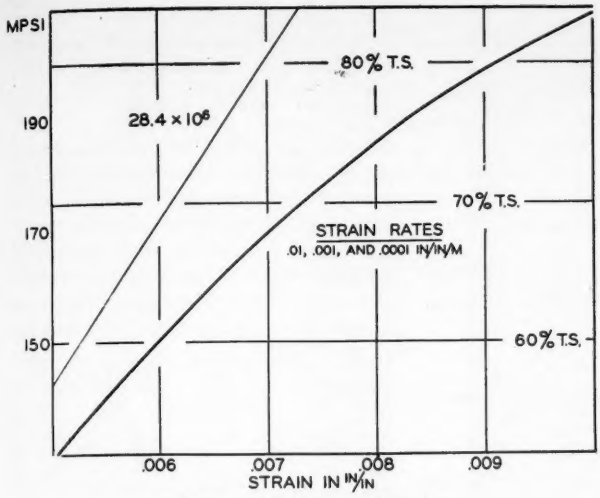


FIGURE 1-PORTION OF ORDINARY STRESS-STRAIN CURVE OF WIRE "A" SHOWING FREEDOM FROM CREEP EFFECTS OVER WIDE RANGE OF STRAIN RATES.

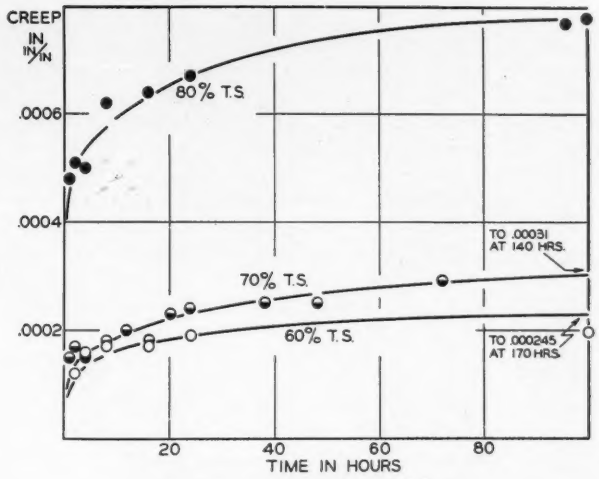


FIGURE 2-CREEP OF WIRE "A" AT VARIOUS STRESS LEVELS.

crease of this rate did not suffice to alter the stress-strain relationships enough to be visible on the generous scale of this drawing. It appears then that the plastic strain which occurs during loading is so rapid that these strain rate changes become relatively minor in affecting the course of this early rapid yielding.

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**The** straining or loading rates which might conceivably occur in practice are well within the range we have just examined. We may therefore confine our attention to the continuation of yielding, or creep, which occurs after loading.

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**The** creep test wires were loaded to constant load control levels at the intermediate rate among those just described (.001 in./in./min.). After such loading, this wire ("A") continued to deform or creep in the manner shown in Figure 2. In the absence of any metallurgical change other than strain-hardening, the rate of creep diminishes progressively with time. The high initial rates are quickly reduced, and the creep curves tend to level off very rapidly. This levelling off takes place more abruptly and at lower levels the lower the stress. The creep rate probably never actually reaches zero, it only seems to be tending to do so because of the rapid change of creep rate with strain.

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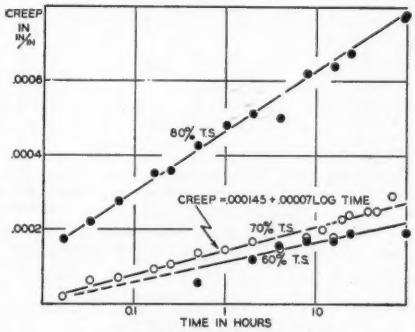


FIGURE 3-CREEP OF WIRE "A" AT VARIOUS STRESS LEVELS SHOWING FIT TO EXPONENTIAL RELATIONSHIP.

**The** remarkable regularity of this diminution is shown in Figure 3 by the excellence of fit to the exponential type of relationship. This evidence justifies extrapolation of these lines to longer times to get some idea, at least, of the long-time creep to be expected with these materials. At the 70 per cent of tensile strength level, extrapolation to 10,000 hours (or a little over a year) indicates a creep or stretching of about six per cent of the initial extension.

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**As** mentioned earlier, there are a number of treatments which can be applied to the cold drawn wire which alter the stress distribution within the wire, and have therefore important effects on the manner of yielding.

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**The** effect on the yielding pattern, as shown by stress-strain curves, of various treatments applied to wire "B" is illustrated in Figure 4. These curves are drawn to the limits of strength and uniform elongation. A stretching operation and two stress-relief heat-treatments, one at higher and one at lower temperatures, all reduced residual stress and gave a more elastic behavior in tensile loading. The stretched wire and the wire stress-relieved at the lower temperature, having lost elongation ductility, exhibit a steeper slope during the last part of the testing sequence, than either the cold drawn wire or the wire stress-relieved at the higher temperature. This circumstance predicts the manner in which these treatments influence the creep behavior of the wire.

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**Figure 5** is a plot of the 24 hour creep of wire "B", in the four different states just described, against stress level. A number of important

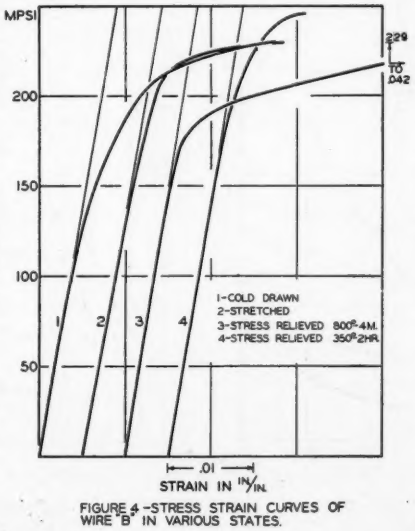


FIGURE 4-STRESS STRAIN CURVES OF WIRE "B" IN VARIOUS STATES.

observations can be made here. Stretching (to 90 per cent of tensile strength) greatly reduces the creep of the cold drawn wire. However, both the cold drawn and the stretched wires creep measurably at the 50 per cent of tensile strength level. Creep at this low level must be due to residual stress, because the stress-relief heat-treatments render the wire creep free (by this measure) up to at least 50 per cent of the tensile strength.

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**The** freedom from creep effects shown by stress-relieved wires, up to about 50 per cent of ultimate strength, and their relative stability, when properly treated, up to some 60 per cent, is an important feature. This advantage and the wire straightness that can be managed in stress-relieving make these wires eminently suitable for linear prestressing. If the working stress is to be considerably above the 50 per cent level, the danger of a too generous stress relief is apparent in the fact that the material treated at 800° creeps considerably more than the other materials at 70 per cent of tensile strength.

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**A very** reasonable explanation for the variation in creep behavior with wire state is suggested by the curves in Figure 6. Here twenty-four hour creep at the higher stress levels is plotted against uniform elongation, which is the stretch which takes place in the wire during the ordinary tensile test, so measured as to discount the elongation due to necking down of the sample. Note that data from both wire "A" and wire "B" fit into the same picture. The uniform or "available" elongation appears then to be a prime factor in determining creep behavior of these high strength steel wires.

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**The** advantage of so managing stress-relief heat-treatments as to produce a reasonably straight wire has been mentioned. Aside from the ease of handling that straightness provides in prestressing applications, it is also of importance in preserving maximum creep resistance. Figure 7, in which one hour creep of wire "B" is plotted against coil set, emphasizes this point, showing that whether the working stress level be 50 or 70 per cent of the tensile strength, a minimum coil set of about 25 feet is indicated for this .0192 inch diameter wire. With smaller coil set, outer fiber stresses set up in pulling the wire to straightness begin to have a relatively large effect on creep.

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**This** same factor of outer fiber stress, of course, determines the degree of set imparted to the wire in reeling after stress-relieving. From the relation

$$D = \frac{dE}{S}$$

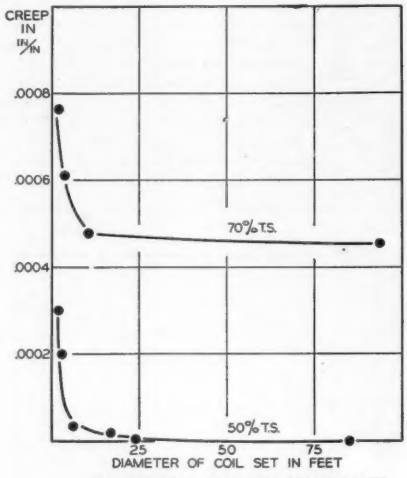


FIGURE 7-EFFECT OF WIRE STRAIGHTNESS ON 1 HOUR CREEP OF WIRE "B" STRESS RELIEVED 800°-4 MIN.

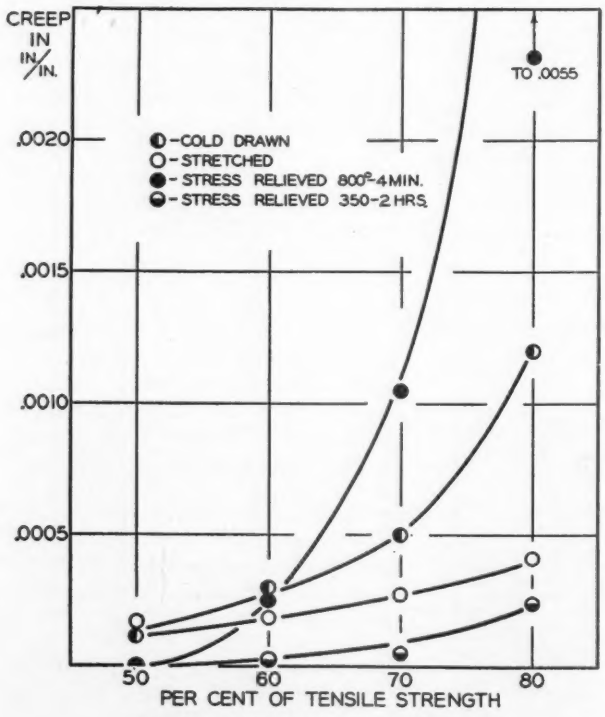


FIGURE 5-CREEP IN 24 HOURS OF WIRE "B" IN VARIOUS STATES.

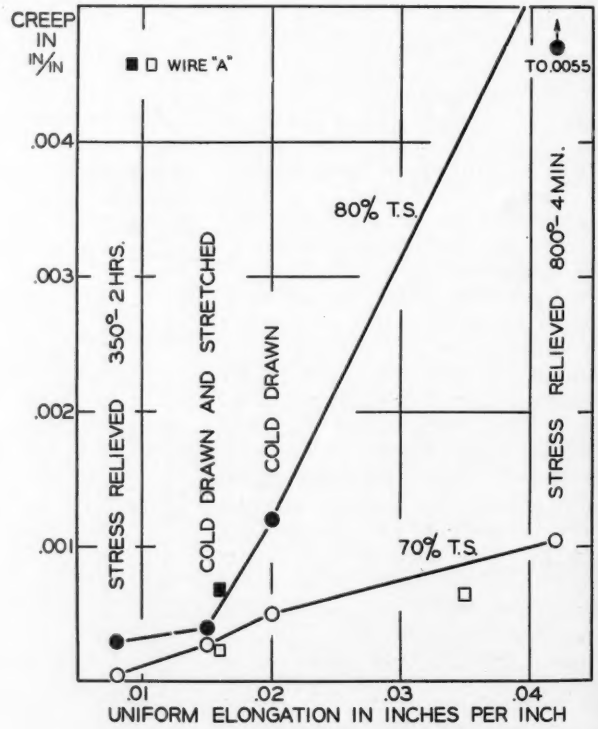


FIGURE 6-CREEP IN 24 HOURS VERSUS UNIFORM ELONGATION. WIRE "B"

where D = diameter of reel
E = elastic modulus of steel
d = diameter of wire
S = outer fiber stress caused by bending straight wire over a reel of the diameter "D",

it appears that suitably straightened and stress-relieved 0.192 inch diameter high strength wire would have to be taken up on reels of about four feet in diameter, or somewhat larger if appreciable wire tension were necessary.

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**While** these creep studies suffice to describe the manner in which load-carrying stability varies with treatment, the actual condition inhering in the prestressing application is closer to that of constant extension or strain. In this case, instability is evidenced by progressive loss in load, or relaxation. Our first wire relaxation tester was designed to take a four or five foot length of wire, but it soon became evident that jaw slippage or relaxation was contributing a large measure of the indicated wire load loss. It can be seen that slippage of only .005 inches would cause a negative strain of about .0001 inches per inch and indicate an additional 80 pounds relaxation (in this 0.192 inch diameter wire). We therefore were compelled to reduce this source of error by some 20 times by building the 100-foot tester shown in Figure 8. A simple mechanical screw jack stretches the wire or strand between stanchions firmly anchored to an eight inch reinforced concrete floor. Load changes are weighed with a load cell.

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**We** have done only a limited amount of work with this tester, but in Figure 9A there are shown relaxation curves of Wire "A" strained to .006 and to .007 inches per inch. These curves are very similar to the creep curves of Figure 2. The high early rates of relaxation diminish rapidly and tend to level off to very low rates. Like the creep figures, these data fit well to the exponential relationship, as can be seen in Figure 9B.

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**It** is interesting to compare the relaxation tests with comparable creep tests on the same wire. The 60 and 70 per cent of tensile strength tests of Wire "A" shown in Figures 2 and 3 provide this comparison. As

mentioned earlier, the 70 per cent test indicates a 10,000 hour creep of about six per cent of initial extension. After such creep, it can be shown that a return to this original strain would give a load loss of some seven per cent. The actual relaxation test of this wire, however, predicts a 10,000 hour load loss of about 9½ per cent. In the same manner, the 60 per cent plot projects to a creep value from which load reduction to initial strain would have to be about 6 per cent. Again the measured relaxation is a little higher, approximately 7 per cent. These figures may be tabulated as follows:

| Stress | Projected 10,000 Hour Relaxation By Creep Test | By Relaxation Test | Strain |
|---|---|---|---|
| 60% T.S. | 6% | 7% | .006 |
| 70% T.S. | 7% | 9½% | .007 |

**Although** it is unwise to base much serious thinking on this single

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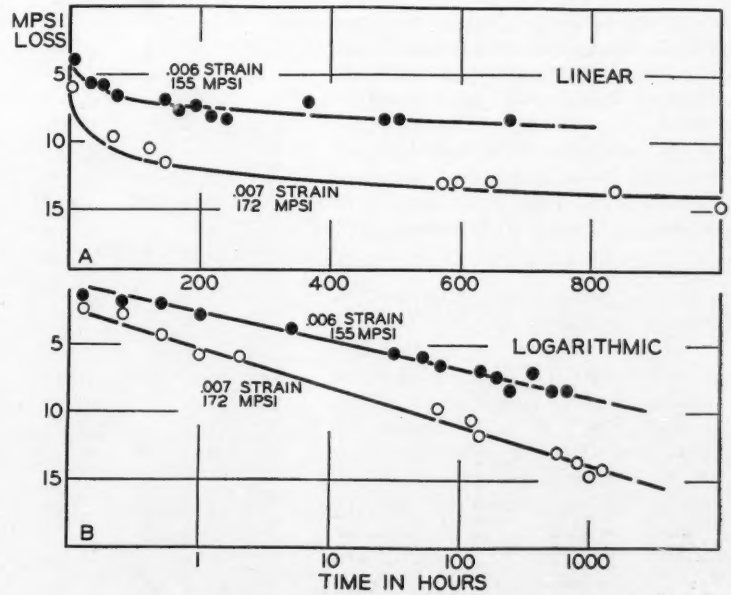


FIGURE 9 - RELAXATION OF WIRE "A" AT .006 AND .007 INCHES PER INCH STRAIN.

# CAN QUALITY CONTROL BE USED IN THE WIRE MILL?

by Henry H. Passolt, Chief Metallurgist
Johnson Steel and Wire Company
Worcester, Massachusetts

**You** have all, no doubt, heard much about Quality Control. It is a subject that is constantly commanding greater attention from Management in all industries. A relatively new national society, "The American Society for Quality Control", holds an annual meeting similar to this one of ours and in addition to monthly meetings in each chapter, has a number of regional conferences of one or two days duration.

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**My** first thought after attending one of these meetings was that Quality Control programs were largely confined to manufacturing processes involving repetitive machining and assembling operations. This I think is an opinion often formed by persons unfamiliar with Quality Control and just what the modern conception of Quality Control embraces. I now know that there is hardly an industry that is not using Quality Control to some extent. As I am not familiar with the operational details of any but the Wire Industry, I naturally questioned how Quality Control could be applied in the Wire Industry and the Steel Industry because these industries have apparently not taken to Quality Control very extensively.

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**At** this point, it might be well to attempt to define Quality Control so we will all look at it from the same view point. For some, Quality Control means diagrams or charts at each machine in a number of operations. These charts, based on proven mathematical formulae, are one of the tools used by Quality Control engineers. The broader concepts of Quality Control are vastly more important than the control charts and in any organization, the charts, etc., are an outgrowth of a program of "doing better according to a plan." It is difficult to define Quality Control in a single definition because it is so all inclusive. Mr. A. V. Fiegenbaum, of the General Electric Company, defines Quality Control as "an effective system for co-ordinating the quality maintenance and improvement efforts of all groups in the manufacturing process so as to enable production at the most economic levels consistent with full consumer satisfaction."

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**In** the Wire Industry, we of necessity have controls at various points in our processing of the rod to the finished wire and in a sense we may, therefore, feel that we have and have had Quality Control for years. These controls have largely been established as a necessary or advantageous means of insuring that successive operations would not be hampered or that the quality of the final product would be up to standard. As examples; pickling and coating solutions are tested and controlled so trouble is not encountered during wire drawing; patent furnace temperatures and speeds are controlled so that wire can be drawn to size without trouble, or so the finished wire will have certain specified physical properties. All industries have process controls of some degree to effect as high a yield as possible of finished product. Controls of this type do not necessarily fall within the scope of modern Quality Control because they may be just isolated instances of control and not part of a coordinated system.

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**The** benefits to be derived from a successful Quality Control program are infinite. Since some benefits are tangible and some intangible, it is essential to set up some means of evaluating the results. If this is not done, the gains may be taken for granted and not realized. There will be a decrease in the amount of rejected wire, a decrease in the cost of production, the quality of the wire will be improved, service will be bettered, and it will be much

**Mr. Passolt graduated from the University of Michigan in 1925 with a B.S. in Chemical Engineering, specializing in metallurgy. He has worked in copper and brass mills in Detroit and Bridgeport, in 1927 becoming a metallurgist in the Research Department of the American Chain and Cable Company's Bridgeport plant. He was transferred to the company's Monessen plant in 1937 to work for the Page Steel and Wire Division. He was put in charge of their stainless steel wire mill in 1940 and in 1941 was made Superintendent of their Carbon Steel Wire Mill. In 1950 he joined his present company as Chief Metallurgist.**

**His paper, showing why he feels that quality control adds to profits, was delivered at the Annual Convention of The Wire Association in Cleveland, Ohio, on November 11, 1952.**

Henry H. Passolt * * * * *

easier to effect changes into the organization as the program takes hold and becomes increasingly effective. In a concern with the most effective program, Quality Control is not the result of effort or accomplishment by any one individual but by all employees from president or manager down to the day laborer.

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**After** top management has decided that it wants and needs Quality Control, the selection of the man to head up the program is of vital importance. The person in charge of Quality Control could be an engineer, a metallurgist, or some person having a general knowledge of the various phases of wire production. He must be a man who has the confidence and respect of top management, department heads, supervisors and workmen. He must be an honest man and must have the ability to cooperate with, and obtain cooperation from men in all positions. He must be helpful to operating men from a technical standpoint and must also be firm in adherence to established standards. He must be able to obtain technical advice from operating men, laboratory men and development men, and then analyze it and apply it to given situations.

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**The** Quality Control program has to start at the top because if the manager of the plant is not thoroughly behind Quality Control to the extent of selling it to the supervisors, it cannot even get started. The head of the plant having decided that Quality Control is advantageous and necessary should then sell it to the supervisory staff. He should explain that it is a program to which all must contribute and that the results will be due to the efforts of all and not just the Quality Control Department. Following this, it would be well for the Quality Control supervisor to outline the approach to a Quality Control program in the mill itself, stressing the part of each supervisor in working out the solution, the manner in which they will have to obtain the cooperation of the workers and the immediate and overall benefits that will result.

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**A specific** problem could then be attacked starting out along the method outlined but making deviations when desirable. At the apparent conclusion of the project the supervisors should be assembled and the role of each supervisor and worker in contributing to the solution of the problem should be stressed. The adjective "apparent" is used because in Quality Control there is never a conclusion as improvements are made continually. Any deviations from the original plan should be reviewed and the reasons for the deviations made clear. If this approach is followed, it will help greatly to instill Quality Control thinking into the organization as a whole. And until this is done, Quality Control is only a phrase and not a living, functioning part of the organization.

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**As** an aid to visualize Quality Control let us consider a problem as handled first in a mill not having Quality Control, then in one which has recently started a Quality Control program. We will assume that there have been several minor complaints of off-gauge wire within a size range of 0.010″ diameter to 0.020″ diameter. The complaints involved wire both under and over the allowable tolerances. The sales manager has passed these complaints along to the works manager. A new complaint is received about a large quantity of wire being rejected for similar reasons and the firm making the complaint cancels all existing orders. Again the sales manager makes the condition known to the works manager, only this time much more forcibly.

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**In** the mill not having Quality Control, the course of action might be for the works manager to meet with the wire mill superintendent or fine wire foreman and the chief inspector or head of the Testing Department and review the complaints with them. The wire mill superintendent or foreman might make excuses about new operators, difficulty in getting dies on size, poor cleaning and coating of the patented wire, or many other factors that often contribute to off-size wire. The chief inspector might say that his inspectors would not knowingly pass off-gauge wire. Both would, of course, promise to investigate and see that the condition is corrected. After the meeting, all three firmly resolve to follow this matter and take corrective measures so it will not happen again. But possibly before the day is even over, more immediate operational problems, labor difficulties, rush orders, etc. have had to receive attention and the problem of off-gauge wire had to be dropped, at least temporarily, by all three. Ultimately, the wire mill superintendent informs his turn foreman and die foreman and cleaning house foreman, and the chief inspector informs his inspectors about the off-size wire complaints. But if specific cause or causes for the off-gauge wire are not found and definite corrective measures taken, it would be logical to assume that the same condition will be repeated in the near future as other problems occupy the time and thoughts of the supervisors, the wire drawers and the inspectors.

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**A course** of action and its result in a mill without Quality Control has been outlined. Many of you can recall similar problems approached in various manners and which were ineffectively solved. Let us then consider this same problem in a mill initiating a Quality Control program.

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**The** works manager would get the wire mill superintendent or fine wire foreman, the chief inspector and the Quality Control head together. The past difficulties about holding gauge within tolerance would be reviewed. It would still be up to the fine wire foreman and inspector to take some immediate corrective action, but the works manager would point out that the Quality Control department would also study the matter to arrive at the most practical long terms solution. The head of the Quality Control department would outline a tentative approach to the problem. This would be followed by an on the spot discussion between the Quality Control head and the fine wire foreman or wire mill superintendent; and later with the chief inspector. At these discussions definite procedures, the functions of the workers and supervisors, any special tagging, records, etc., would

(*Please turn to page* 1121)

# Silicone Rubber: A New Insulating Material for Wire and Cable

by M. G. Noble, Application Engineer,
Silicone Products Department,
General Electric Company,
Waterford, N. Y.

**The** wire and cable industry has many materials available for use as electrical insulation. At first glance, the outsider finds it difficult to conceive how materials with such diverse properties as rubber and asbestos—thermoplastics and paper—varnished cambric and enamels can be used for the same fundamental purpose. Yet, all are employed to insulate current-carrying conductors in the electrical industry.

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**The** obvious answer is that the industry has many, widely-varied ramifications. Large power lines pose physical, electrical and chemical problems requiring far different constructions from those used in winding motors or lighting houses. The insulation material suitable for one application is frequently inadequate to meet the requirements of another.

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**There** is no all-purpose insulation. Each material offers a combination of advantages, average properties, and disadvantages. Consequently, the electrical engineer must design his cables with careful attention to the specific application involved, incorporating as many "plus" and as few "minus" qualities as possible.

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**The** past twenty years have witnessed the development of many new elastomeric insulators. Each new polymer has been evaluated and accepted to the extent that it has overcome weaknesses in existing systems. One of the latest and most promising elastomers to appear on the scene is silicone rubber.

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**Silicone rubber** was introduced as extruded, electrical insulation about 8 to 10 years ago. As mentioned previously, for a new material to be considered, it must offer some "plus" factor not present in existing materials. Silicone rubber offered the fabricator exceptional thermal stability. All previous elastomers, being organic in nature, could not be operated continuously at temperatures appreciably above 100°C (212° F). Silicones enabled the engineer to design cables to operate at 200°C (392°F).

**This paper, presented before the Annual Convention of The Wire Association on November 11, 1952, in Cleveland, Ohio, sets forth the properties and the processing of silicone rubber as an insulating material.**

**The author graduated from Alfred University in 1939 with a Bachelor of Science degree and from Brooklyn Polytechnic Institute in 1946 with a Master of Science degree.**

**From 1940 to 1942 he was with the American Hard Rubber Company at Butler, N. J. and from 1942 to 1951 with the General Cable Corporation in Bayonne, N. J. From there he went to his present connection, the General Electric Company.**

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**The** "minus" factors were strongly in evidence in the early silicone rubbers. They were physically weak, difficult to process, and expensive. Few applications were readily apparent. Barriers, both practical and psychological, had to be overcome.

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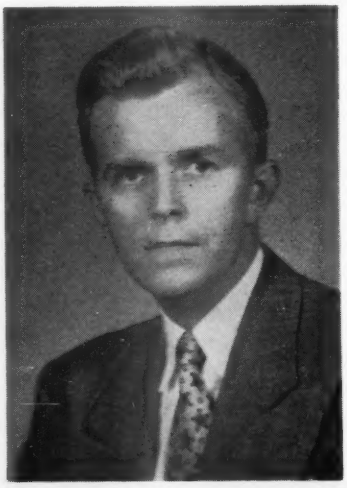

M. G. NOBLE

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**Today,** the picture has changed considerably. New and better compounds have been developed which have overcome many former weaknesses. The years of intensive study and investigation have produced numerous reasons for use of silicone rubber in the wire and cable industry. Applications are continually being discovered where the properties peculiar to silicone rubber have fulfilled a need which no other known material could satisfy. Wire and cable companies have acquired processing "know-how." Silicone rubber is now an established material.

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## What is Silicone Rubber?

**The** difference in properties between silicone and organic rubber compounds is attributable to the difference in chemical structure between the base rubber gums.

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**Organic** rubber gums are based on a backbone of carbon atoms chemically combined to form a high molecular weight compound. Their spread in physical and electrical properties is influenced by variations in the substituent groups. The latter vary widely: simple hydrogen atoms, methyl or phenyl groups, chlorides, nitriles, and others.

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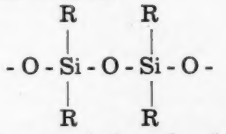
**Silicone** rubber gums may be described chemically as polyorganosiloxanes. The structure may be indicated as follows:




It will be noted that the dominant feature is a skeleton of alternating silicon and oxygen atoms. The R, or substitutent groups, usually represent alkyl or aryl components.

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President
L. C. CREWE, Jr., President
Maryland Fine & Specialty Wire Co.
Cockeysville, Maryland

# THE WIRE ASSOCIATION

453 MAIN STREET
STAMFORD, CONN.

Official Publications
"Wire and Wire Products"
"Wire and Wire Products Buyers Guide and Year Book of the Association"

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Ralph B. Roth,
Vice President and Sec'y
Ludlow Saylor Wire Co.
St. Louis, Mo.

Executive Secretary
RICHARD E. BROWN
453 Main Street
Stamford, Conn.


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Fred M. Crapo, President,
Indiana Steel & Wire Co.,
Muncie, Indiana


Titles and connections of Past Presidents are those at the time each held office.

The Wire Association is a non-profit organization of wire mill executives, superintendents and foremen. It also includes plant engineers, traffic men, and all others engaged in the production of cold drawn bars, rods, wire, strip, insulated wire and cable, and the manufacture and fabrication of finished wire products, including cold headed, extruded and other cold worked metal products.

There are separate divisions for all the various major interests in the wire industry, steel, iron, brass, copper, alloy, and precious metals, together with divisions relating to drawing, cold working, cold heading, extruding, fabricating, forming, spring making, wire cloth, wire rope, bare and covered electric wire and cable and all other forms of wire and wire products.

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## PURPOSES

Its specific purpose is to improve production methods and afford a clearing house for ideas on management problems, technical problems, and research work in all phases of practical wire drawing and wire working, and to develop and maintain friendly relations among the members.

## ACTIVITIES

The Association functions along the following lines:

1. The use of the Association headquarters as a central clearing house for information and data of all kinds which may be of interest to members.
2. The exchange of ideas on processes of production including machinery, technical processes, etc.
3. The establishment and maintenance of friendly relations among the members of the association and the development of sectional and national meetings to discuss matters of mutual interest.
4. Studies of production methods and analysis of production costs.
5. Developments in the use of new materials and new applications of existing materials and by-products.
6. Research and collection of information on personnel management, including such factors as labor turnover, seasonal changes in the demand for employees, wage scales, etc.
7. Standardization and simplification as a means for the effective elimination of waste.
8. Such other subjects as may be determined upon.

# PROGRAM

## Annual Convention of The Wire Association

## Carter Hotel, Cleveland, Ohio, November 10-13, 1952

The Wire Association's Headquarters at The Carter Hotel
will be open from Monday, November 10th, every evening during the Convention.
Come and get acquainted!

THERE WILL BE A REGISTRATION FEE OF $6.00 FOR THOSE ATTENDING
THE TECHNICAL SESSIONS AND INFORMAL MEETINGS.

ADMISSION WILL BE BY BADGE ONLY—PLEASE WEAR IT.

### THE WIRE ASSOCIATION PROGRAM COMMITTEE FOR THE 1952 CONVENTION

GENERAL CHAIRMAN

Leonard C. Crewe, Jr., President
Maryland Fine & Specialty Wire Co., Cockeysville, Md.

VICE CHAIRMAN

Walter B. McShane
American Steel & Wire Division
U. S. Steel Co., Cleveland, O.

#### FERROUS DIVISION

CHAIRMAN

Robert C. Peterson, Production Mgr.
Thompson Wire Co., Worcester, Mass.

COMMITTEE MEMBERS

E. Jefferson Crum
Technical Consultant
R. H. Miller Co., Homer, N. Y.

Uno V. Johnson, Superintendent
Portsmouth Steel Division
Detroit Steel Corp., Portsmouth, O.

Joseph R. Carter, Vice Pres. & Genl. Mgr.
Johnson Steel & Wire Division
Pittsburgh Steel Co., Worcester, Mass.

William E. Hitchcock, Jr., Vice Pres.
Atlantic Wire Co., Branford, Conn.

D. M. Schmid, Vice Pres.
Alloy Metal Wire Co., Prospect Park, Pa.

Technical papers are preprinted in the October issue of Wire and Wire Products insofar as possible. Titles to papers accepted will be given to the Wire Association and duly copyrighted at the time of publication.

#### GENERAL ACTIVITIES

EXECUTIVE SECRETARY

Richard E. Brown
The Wire Association
Stamford, Conn.

REGISTRATION

R. S. Spengel, Asst. Exec. Secy.
The Wire Association
Stamford, Conn.

ENTERTAINMENT

Eber J. Hubbard, President
Hubbard Spool Company
Garrett, Ind.

All papers presented at this Convention by members of The Wire Association are eligible for consideration for the Annual Medal Award, and will be voted upon by the Board of Directors at the next Spring meeting of that body.

#### NON-FERROUS DIVISION

CHAIRMAN

Leslie C. Whitney, Chief Met.
Copperweld Steel Corp., Glassport, Pa.

COMMITTEE MEMBERS

Howard H. Allen, Pres.
Nonotuck Manufacturing Co.,
Holyoke, Mass.

Willard deC. Crater, Asst. Mgr., Vinyl Sales
Naugatuck Chemical Division
U. S. Rubber Co., Naugatuck, Conn.

James E. Flood, Chief Chemist
Plastic Wire and Cable Corp.,
Jewett City, Conn.

C. E. Jackson, Chf. Chem.
Paranite Wire & Cable Div.,
Essex Wire Corp., Marion, Ind.

William L. Wells, Asst. Supt., Rod Mill
Scovill Manufacturing Co., Waterbury, Conn.

All wire mill men and suppliers are invited to attend this meeting, see how the Association functions and participate in the activities.

Hotel reservations should be made by members of the Wire Association direct to the Secretary.
MAKE YOUR PLANS NOW TO ATTEND AND SEND YOUR RESERVATION PROMPTLY

### MONDAY, NOVEMBER 10th

| 9:00 A. M. | 10:30 A. M | 12:30 P. M. |
|---|---|---|
| REGISTRATION | DIRECTORS' MEETING | PROGRAM COMMITTEE LUNCHEON |

# THE CONVENTION PROGRAM

## Carter Hotel, Cleveland, Ohio, November 10-13, 1952

## MONDAY, NOVEMBER 10th

9:00 A.M. Registration Desk opens on the mezzanine floor.

10:30 A.M. Annual Meeting of the Board of Directors of the Wire Association.

12:30 P.M. Directors' Luncheon for Program Participants.

AFTERNOON SESSION—2:00 P.M.

Joint Technical Meeting for Both Ferrous and Non-Ferrous Groups.

CHAIRMAN OF MEETING

E. Jefferson Crum, Technical Consultant, R. H. Miller Co., Homer, N. Y.

Address of Welcome by Leonard C. Crewe, Jr., President, Maryland Fine and Specialty Wire Co., Cockeysville, Md.
President of The Wire Association

| | | |
|---|---|---|
| PAPER: "Manufacture of Copper-Steel Wire by Electrolytic Process." | For many electrical applications, a copper-coated steel wire will serve and copper can be saved. How good coatings are produced is described. | by A. M. Gray, Asst. Supt., Development Eng.<br>Western Electric Company<br>Baltimore, Md. |
| PAPER: "Methods Improvement Study." | A discussion supplemented by a motion picture and slides, in which various methods of improving operations are depicted. | by Paul V. Crooks, Works Indus. Engr.<br>Newburg Works<br>American Steel and Wire Div.<br>U. S. Steel Company<br>Cleveland, Ohio |

## TUESDAY, NOVEMBER 11th

MORNING SESSIONS—9:30 A.M.

### FERROUS SECTION

CHAIRMAN OF MEETING

Uno V. Johnson, Supt., Rod & Wire Div., Detroit Steel Corp., Portsmouth, Ohio.

| | | |
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| PAPER: "Lime for Wire Drawing." | Discussion of improvement in lime coating through use of recirculating system, based on experience at Sparrows Point. | by Jere Heisler, Asst. Gen. Foreman, Wire Drawing<br>Bethlehem Steel Company<br>Sparrows Point, Md. |
| PAPER: "ACSR Wire." | The metallurgical requirements and manufacturing procedure in producing ACSR wire. | Frank Weise, Jr., Asst. Supt., Rods & Wire<br>Portsmouth Steel Div.<br>Detroit Steel Corp.,<br>Portsmouth, Ohio. |
| PAPER: "Selection and Processing of Chromium-Nickel Stainless Steels for Magnetic Applications." | A review of the effect of chemical composition and processing on the properties of these steels. | by F. K. Bloom & J. S. White, Metallurgists<br>Rustless Div., Armco Steel Corp.<br>Baltimore, Md. |

### NON-FERROUS SECTION

CHAIRMAN OF MEETING

Willard DeC. Crater, Asst. Mgr. Vinyl Sales, Naugatuck Chemical Co., Naugatuck, Conn.

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| PAPER: "Glass Micro Fibers in the Wire Industry." | The characteristics and applications of yarns made of the new super-fine glass filaments. | by K. J. Busse, Sales Mgr.<br>Micro Fiber Division<br>Glass Fibers, Inc.<br>Toledo, Ohio. |
| PAPER: "The Development of Improved Electrical Wiring Materials." | The case history of a new barn cable and principles that control new product developments. | by Vincent McBride, Chief Eng.<br>Plastic Wire and Cable Corp.<br>Jewett City, Conn. |
| PAPER: "Development of New Asbestos Insulated Magnet Wires." | The Application of a new asbestos product in combination with Fiberglas and Silicone varnish (for Class H Temps) or with Dacron Yarn (for Class B Temps) for high temperature magnet wires. | by Robert D. Peck, Dist. Engr.<br>Industrial Products Div.<br>Johns-Manville Sales Corp.<br>Boston, Mass.<br>and<br>Edward B. Hall, Met.<br>Kennecott Wire & Cable Co.<br>Phillipsdale, R. I. |

## TUESDAY, NOVEMBER 11th (cont'd)

AFTERNOON SESSION—2:00 P.M.

### FERROUS SECTION

CHAIRMAN OF MEETING

Joseph R. Carter, Johnson Steel & Wire Co., Worcester, Mass.

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| PAPER "The Drawing of Weaving Wire." | The progress made in weaving wire manufacture, with emphasis on present-day practices. | by Albert Knapp, V.P. & Chf. Eng. G. F. Wright Steel & Wire Co. Worcester, Mass. |
| PAPER: "Can Quality Control Be Used in the Wire Mill?" | Considers benefits of quality control thinking and traces typical problem through mill with and without quality control. | by H. H. Passolt, Metallurgist Johnson Steel and Wire Co. Worcester, Mass. |
| PAPER: "Significance of The Elongation Test on Wire." | Limitations of percentage elongation illustrated and more reliable measures of ductility of hard drawn wire suggested. | by H. J. Godfrey, Asst. Chief Eng. Research and Development John A. Roebling's Sons Co. Trenton, N. J. |

### NON-FERROUS SECTION

CHAIRMAN OF MEETING

James E. Flood, Chem. Eng., Plastic Wire & Cable Co., Jewett City, Conn.

| | | |
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| PAPER: "Dry Blending for the Vinyl Extrusion Industry." | The reasons for dry-blending vinyl compounds, the methods used and late developments that have improved them. | by M. G. Caine, Asst. Sales Mgr. Plastics Division Monsanto Chemical Co. Springfield, Mass. |
| PAPER: "Silicone Rubber: A New Insulating Material for Wire and Cable." | Describes silicone rubber and its history, processing technique, properties and applications. Comparisons with organic elastomers are made. | by M. G. Noble, Application Eng., Silicone Products Engineering, Chemical Div. General Electric Co. Waterford, N. Y. |
| PAPER:" Weathering Characteristic of Polyvinyl Chloride Type Plastics." | A study of major factors involved in making PVC compounds for outdoor use. Weathering tests are evaluated. | by J. G. Hendricks, Director and E. L. White, Asst. Director High Polymer Laboratory National Lead Co. Brooklyn, N. Y. |

## WEDNESDAY, NOVEMBER 12th

MORNING SESSIONS—9:30 A.M.

### FERROUS SECTION

CHAIRMAN OF MEETING

William E. Hitchcock, Jr., Vice Pres., Atlantic Wire Co., Branford, Conn.

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| PAPER: "Creep and Relaxation of High Strength Steel Wires at Room Temperature." | Results of measurement of these characteristics in two wires subjected to high sustained stress or strain. | by Gordon T. Spare, Project Eng. American Steel & Wire Div. U. S. Steel Company Cleveland, Ohio. |
| PAPER: "Salt vs. Atmospheric Annealing." | Experience based on the use of both types of furnaces with indication as to which work each is adapted. | by E. S. Tyler, Metallurgist Atlantic Wire Co. Branford, Conn. |
| PAPER: "Design of a Galvanizing Furnace." | The author's company has designed and built five furnaces. The factors entering into the design of the latest oil fired furnace are discussed. | by William D. Bawden, Works Mgr. Gilbert and Bennett Mfg. Co. Georgetown, Conn. |

### NON-FERROUS SECTION

CHAIRMAN OF MEETING

William L. Wells, Asst. Supt., Rod Mill, Scovill Mfg. Co., Waterbury, Conn.

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|---|---|---|
| PAPER: "Effect of Certain Impurities on Free Cutting Brass." | Copper shortage has forced use of poorer grades in making brass. Effect of impurities found are discussed. | by Grayson B. Wood, Jr., Metallurgist Scovill Manufacturing Co. Waterbury, Conn. |
| PAPER: "Cost Reduction Through Improved Plant Layout." | With material and labor costs rising, saving must be made through more efficient plant operation. | by D. M. Schmid, Vice Pres. & Genl. Mgr. Alloy Metal Wire Co. Prospect Park, Pa. |
| PAPER: "Control of Wet Wire Drawing Solutions for Copper." | An outline of practices showing how to start with the right solution and then to maintain it at a point of efficiency. | by Dr. Robert C. Williams Director of Research The Ironsides Company Columbus, Ohio. |

## WEDNESDAY, NOVEMBER 12th (cont'd)

AT 1:00 P.M.—THE ANNUAL WIRE ASSOCIATION LUNCHEON

Guest Speaker: Harvey B. Jordan, President, The American Steel & Wire Div., U. S. Steel Co., Cleveland, Ohio.

*LADIES WELCOME!* *LADIES WELCOME!*

The Mordica Memorial Lecture: "Three Score and Ten Years of Wire Making."
by Peter Igoe, Treasurer, Igoe Brothers, Inc., Newark, N. J.

THE PRESENTATION OF AWARDS FOR 1951

Medal Award: Dr. Bruce W. Gonser, Research Supervisor, Non Ferrous Metallurgy, Battelle Memorial Institute, Columbus, Ohio. for the most meritorious paper: "High Strength Copper-Silver, Copper-Iron and Copper-Iron-Chromium Wire."

Certificate of Honorable Mention for ferrous papers: Dr. Carl A. Zapffe, Consulting Engineer, Baltimore, Md., for the paper: "Surface Active Agents and Pickling Brittleness."

Certificate of Honorable Mention for non-ferrous papers: C. A. Litzler, President, Industrial Ovens, Inc., Cleveland, Ohio, for the paper: "Some Developments in Nylon and Polyethylene Wire Extrusion."

AT 4:00 P.M.—THE ANNUAL MEETING OF THE WIRE ASSOCIATION

This is the annual business meeting of members of the Association. Your personal attendance is needed and urged.

Chairman of Meeting
Leonard C. Crewe, Jr., Pres.
The Wire Association

IN THE EVENING:

### THE ANNUAL STAG SMOKER—DINNER

6:30 P.M.—Cocktail Bar Opens
7:30 P.M.—Dinner and Show

CHAIRMAN, ENTERTAINMENT COMMITTEE: Eber J. Hubbard, Jr.

COME ONE, COME ALL—AND HAVE A GOOD TIME!

## THURSDAY, NOVEMBER 13th

This day will be devoted to plant inspection tours, two of which have been planned. These are to:

CUYAHOGA WORKS, AMERICAN STEEL & WIRE DIV., U. S. STEEL CORP.
Busses will leave the Carter Hotel at 9:30 A.M. and will return to the hotel at noon.

CLEVELAND WORKS, CHASE BRASS & COPPER CORPORATION
Busses will leave the Carter Hotel at 1:30 P.M., returning to the to the hotel before 5 P.M.

FOR EACH TOUR, PERSONS MUST GO BY BUS. NO PRIVATE CARS WILL BE ADMITTED AND TO BE ACCEPTED AT THE GATE, YOU MUST WEAR YOUR BADGE. THESE MEASURES ARE FOR SECURITY REASONS. NO EXCEPTIONS, PLEASE!

These Plant Inspection Trips Conclude the 1952 Convention

RESEARCH PAPERS ARE PREPRINTED IN THE OCTOBER ISSUE OF WIRE AND WIRE PRODUCTS

The Discussions and the Mordica Memorial Lecture will be printed in the January issue of Wire and Wire Products

Papers not received in time for preprinting will be published in the November and December issues of Wire and Wire Products.

## THE ANNUAL MEDAL AWARDS
## presented by
## THE WIRE ASSOCIATION
### FOR THE MOST MERITORIOUS PAPER ON WIRE MANUFACTURE OR FABRICATION DURING THE YEAR

**1934 — EDWARD J. P. FISHER**
Metallurgist, Keystone Steel & Wire Co., Peoria, Ill.
Title of Paper: "COLD DRAWN STEEL SPRING WIRE"

**1935 — BENJAMIN LEWIS McCARTHY**
Metallurgist, Wickwire Spencer Steel, Buffalo, N. Y.
Title of Paper: "GRAIN SIZE AND ITS INFLUENCE ON THE MANUFACTURE OF STEEL WIRE"

**1936 — ROBERT NOTVEST**
Chief Engineer, Welding Division, J. D. Adams Mfg. Co., Indianapolis, Ind.
Title of Paper: "STEEL FOR ARC WELDING ELECTRODES"

**1937 — BENJAMIN LEWIS McCARTHY**
Chief Metallurgist, Wickwire Spencer Steel, Buffalo, N. Y.
Title of Paper: "ABNORMAL GRAIN GROWTH AND THE ANNEALING OF LOW CARBON STEEL WIRE"

**1938 — WALTER R. BLOXDORF**
Metallurgist, The MacWhyte Co., Kenosha, Wis.
Title of Paper: "WIRE ROPE"

**1939 — STANLEY P. WATKINS**
Manager, Sales Development, Rustless Iron and Steel Corp., Baltimore, Md.
Title of Paper: "THE MANUFACTURE AND USE OF STAINLESS STEEL WIRE"

**1940 — ROBERT W. SANDELIN**
Metallurgist, Atlantic Steel Company, Atlanta, Georgia
Title of Paper: "GALVANIZING CHARACTERISTICS OF DIFFERENT TYPES OF STEEL"

**1941 — CARLETON W. GARRETT**
Wire Mill Metallurgist, Aliquippa Works, Jones & Loughlin Steel Corp., Aliquippa, Pa.
Title of Paper: "A BRIEF DISCUSSION ON THE MANUFACTURE OF STEEL FOR ARC WELDING ELECTRODES"

**1942 — LEROY DEVOE SEYMOUR**
Asst. Works Manager, Canada Works, Steel Company of Canada, Ltd., Hamilton, Ont., Canada
Title of Paper: "SCHEDULING AND PLANNING THE WIRE MILL FOR WAR PRODUCTION"

**1943 — JOHN C. AIKEN**
Asst. Supt., Rod and Wire Mills, Jones & Laughlin Steel Corp., Aliquippa, Pa.
Title of Paper: "DRAWING HIGH SPEED ROPE WIRE"

**1944 — AUGUST R. ZAPP**
Manager, Carbides Division, Firth-Sterling Steel Company, McKeesport, Pa.
Title of Paper: "HISTORY AND GROWTH OF THE TUNGSTEN CARBIDE DIE"

**1945 — MATTHEW J. DONACHIE**
Consulting Metallurgical Engineer, Holyoke, Mass.
Title of Paper: "SOME TRAITS AND CHARACTERISTICS IN THE WORKING OF BERYLLIUM-COPPER WIRE"

**1946 — NO AWARD** **1947 — NO AWARD**

**1948 — REGINALD S. BROWN**
Chief Metallurgist, Rylands Brothers Limited, Warrington, England.
Title of Paper: "WEAR RESISTANCE OF WIRE FOR WIRE ROPE"

**1949 — JOHN H. CORSON**
Metallurgist, John A. Roebling's Sons Co., Roebling, N. J.
Title of Paper: "WELDING IN THE WIRE INDUSTRY"

**1950 — CURTIS VOIGTLANDER**
Superintendent, Wire Mills, Union Wire Rope Corp., Kansas City, Mo.
Title of Paper: "BORAX AS A COATING FOR DRAWING HIGH CARBON STEEL WIRE"

**1951 — DR. BRUCE W. GONSER**
Research Supervisor, Non-Ferrous Metallurgy, Battelle Memorial Institute, Columbus, Ohio
Title of Paper: "HIGH STRENGTH COPPER-SILVER, COPPER-IRON AND COPPER-IRON—CHROMIUM WIRE"

## MORDICA MEMORIAL LECTURES AND LECTURERS
## FOR YEARS 1939 THRU 1951

**OCTOBER, 1939, PRINTED JANUARY, 1940**
A Correlation of the Factors and Effects of Cold Drawing of Wire Rods
By S. A. Braley, Chf. Met. Field Engr., Pittsburgh Steel Company, Pittsburgh, Pa.

**OCTOBER, 1940, PRINTED JANUARY, 1941**
The Use of Plant Polarized Light and Sensitive Tint Illumination in the Analysis of the Microstructure of Steel
By B. L. McCarthy, Chf. Met., Wickwire Spencer Steel Company, Buffalo, N. Y.

**OCTOBER, 1941, PRINTED JANUARY, 1942**
The Shape of Things to Come
By Kenneth B. Lewis, Consulting Wire Mill Engr., Worcester, Mass.

**OCTOBER, 1942, PRINTED JANUARY, 1943**
Steel & Wire
By Louis H. Winkler, Met. Engr., Bethlehem Steel Company, Bethlehem, Pa.

**OCTOBER, 1943, PRINTED JANUARY, 1944**
The Wire Drawing Die
By Flint C. Elder, American Steel & Wire Company, Cleveland, Ohio

**OCTOBER, 1944, PRINTED JANUARY, 1945**
Carbon Steel for the Wire Industry
By A. M. Reeder, Met. Engr., Jones & Laughlin Steel Corp., Pittsburgh, Pa.

**OCTOBER, 1945, PRINTED JANUARY, 1946**
Boundaries
By John C. Callaghan, Works Manager, Canada Works, Steel Company of Canada, Ltd., Hamilton, Ontario, Canada

**OCTOBER, 1946, PRINTED JANUARY, 1947**
Galvanized Steel Wire
By Fred M. Crapo, President, Indiana Steel & Wire Company, Muncie, Indiana

**OCTOBER, 1947, PRINTED JANUARY, 1948**
Wire in the Automobile
By F. Titus Updike, Chf. Products Engr., Products Eng'g Dept., Round Wire & Cold Rolled
Products Division, John A. Roebling's Sons Co., Trenton, New Jersey

**OCTOBER, 1948, PRINTED JANUARY, 1949**
54 Years in the Wire Business
By C. L. McGowan, Supt., Wire Mills, Atlantic Steel Company, Atlanta, Georgia

**OCTOBER, 1949, PRINTED JANUARY, 1950**
Corrosion of Steel and Its Protective Metallic Coatings
By Alan B. Dove, Works Manager, Dominion Works, Steel Company of Canada, Ltd., Lachine, Quebec, Canada

**OCTOBER, 1950, PRINTED JANUARY, 1951**
The Design and Manufacture of Woven Wire Fence
By Julian L. Schueler, Gen'l. Supt., Continental Steel Corporation, Kokomo, Indiana

**OCTOBER, 1951, PRINTED JANUARY, 1952**
The Fabrication of Copper Wire
By Sidney Rolle, Ass't Mgr., The Scomet Company, New York, N. Y.

**Silicone** rubber is a high polymeric material. The molecular weight is large (averaging 500,000) and even exceeds values reported for many common organic elastomers.

★ ★ ★

**As** with organic rubbers, silicone must be compounded to obtain desirable performance properties. However, silicone compounds are much less complex. There is no need for the multitude of accelerators, anti-oxidants, softeners and the like which must be incorporated into organic rubbers. Silicone compounds are reinforced by the addition of inorganic fillers—silica, calcium carbonate, lithopone, titanium dioxide, iron oxide, and others.

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**Peroxide-type** catalysts are added as curing agents. Vulcanization proceeds by a free-radical mechanism. Selective oxidation is induced which apparently causes oxidation of hydrogen atoms on the substituent groups and the formation of methylene cross-links between the polyorganosiloxane molecules.

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**The** only other additives commonly employed are inorganic pigments. A variety of colors can be produced depending to some extent on the specific reinforcing fillers employed.

**TABLE NO. 1**

**SILICONE RUBBER COMPOUNDS RANGE OF AVAILABLE PHYSICAL PROPERTIES**

| | |
|---|---|
| Durometer (Shore A) | 30 to 90 |
| Tensile Strength, psi | 400 to 1000 |
| Ultimate Elongation, % | 40 to 600 |
| Compression Set (Method B), % | |
| 22 hr. at 158 F (70 C) | 2 to 60 |
| 70 hr. at 300 F (149 C) | 15 to 80 |
| Tear Strength (Die C), lb./in. | 20 to 100 |

## How is Silicone Rubber Processed?

**Silicones** are mixed on conventional equipment used in the rubber industry. Ingredients can be incorporated by the use of internal mixers or open mills. The only significant variable is that processing temperatures must be kept low to inhibit decomposition of the peroxide catalyst.

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**The** compounds can be fabricated using standard or slightly modified molding, calendering, dipping and extrusion techniques. The latter apply specifically to the processing of insulated wire and cable and will be discussed in some detail subsequently.

★ ★ ★

**Vulcanization** is effected by exposing the fabricated part to elevated temperatures in a press, steam, or oven curing operation. When steam cures are used exposure time is quite critical. Steam will initiate cure, but too long exposure will result in degradation of the rubber. It is advisable to keep exposure time to a minimum. Silicones differ from organic rubbers in that press and steam cures are normally followed by an air oven curing cycle to produce the optimum combination of properties. The exact cure used will be a function of the dimensions of the fabricated article and the operating temperature required by the application. A "rule-of-thumb" is that the silicone rubber should be cured at a final temperature approximating that temperature which may be encountered during operation.

## Silicone Rubber As Wire Insulation Part I—Processing

**The** early silicone rubber compounds were difficult to process. They approached soft putty in physical appearance and required special milling and extrusion techniques.

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**Today** a wide range of silicones are available. The compounds are adjusted to the specific application involved. Extrusion-grade stocks are designed to have a degree of toughness in their uncured state which permits handling on mills and in extruders with the minimum of difficulty. At the same time, when subjected to a shearing stress, rapid softening occurs which facilitates extrusion at high rates of speed.

★ ★ ★

**A milling**, or freshening, operation prior to extrusion is recommended for most silicone rubber compounds; 10 — 15 minutes on standard-size mills is all that is normally required. Certain formulations have been developed which permit the elimination of pre-milling with its attendant operational cost and possibilities for contamination. The latter is significant in that organic contaminants will carbonize at the high operating temperatures for which silicones are designed, and inorganic particles may cause electrical failures under voltage during processing or in operation.

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**Silicones** lend themselves to conventional extrusion processing. The wire industry uses several variations: continuous vulcanization, pan tubing and drum curing.

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**Continuous** vulcanization (CV) is the most popular. In this process, the conductor is insulated and the insulation cured in one operation. Curing is effected by passing the insulated conductor through a 100-250 ft. tube where it is exposed to an atmosphere of live steam. Pressures of 100-250 psi are used. The speed of extrusion is influenced by such variables as auxiliary feeding equipment, screw and tool design. The length of the steam tube is a limiting factor insofar as the rubber must be exposed to steam for a minimum period of time to impart useable physical properties. A minimum of 25-30 seconds is normally required. An interesting difference between silicones and organic rubbers is that the physical properties of silicones are not influenced by CV-processing conditions within the workable range. That is, the same values for elongation and tensile strength of the insulation are obtained when processed at high extrusion speeds and low steam pressures as when processed at low speeds and high pressures. Organic rubber compounds increase in tensile strength and decrease in elongation when processed at higher pressures or lower speeds.

★ ★ ★

**Pan** tubing and drum curing are variations in which the insulated conductor is taken up in pans or on drums prior to curing. These procedures are batch-wise rather than continuous. Curing takes place in steam autoclaves by exposure for 5-10 minutes to an atmosphere of 40-60 psi steam.

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**Steam** curing imparts desirable physical and electrical properties to silicone rubber. However, for optimum values, a subsequent bake in a circulating air oven is recom-

mended. The bake eliminates residual moisture and other volatiles. Oven temperatures may be varied from 70-250° C (158 to 482° F) with exposure periods of 4-48 hours or longer. Ultimate operating conditions will influence the oven baking cycle.

## Part II—Properties

**The** fundamental properties of silicone rubber insulation compounds are a function of the base polymer. However, they are influenced by the nature of the incorporated fillers and by the curing cycle used during processing. The selection of the proper compound for any application is determined by the operating conditions to be encountered.

### (1) Physical

**Silicones** possess the outstanding characteristic of resistance to temperature extremes. Compounds can operate continuously at 200° C (392° F) with no significant change in properties. Higher service temperatures are feasible depending on the life expectancy required and the severity of operating conditions.

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**At the** other end of the temperature scale, silicones are available which remain flexible below —85° C (—121° F). Organic elastomers are formulated for low temperature service by the addition of liquid plasticizers. The same formulations would not be suitable for high temperature applications. Silicones contain no plasticizers and still remain flexible at much lower temperatures than can be achieved with organic rubbers. The same silicone rubber compound can be used for both high and low temperature performance.

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**The** tensile strength, elongation and abrasion resistance of silicones at ordinary temperatures are not as great as those of organic rubber compounds. However, these properties of silicones are far superior after exposure to elevated temperatures. After only one hour at 200° C (392° F) heat-resistant organic rubber deteriorates rapidly and the physicals fall below those of silicones. Values progressively become worse.

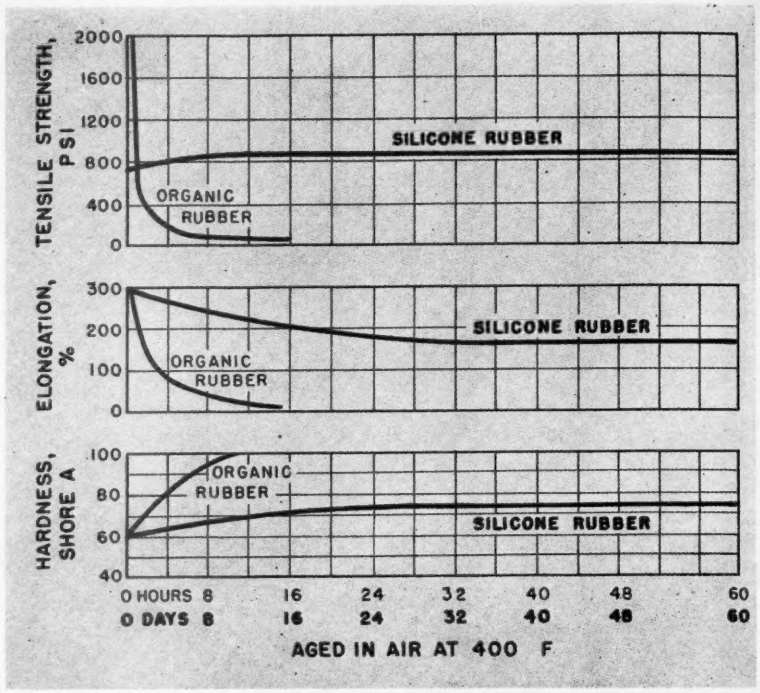


Fig. 1—Note that the time scale for the organic rubber is hours, while that for the silicone rubber is days. Before aging the organic rubber had superior tensile strength and elongation, but after only about an hour at 400F, the organic rubber had deteriorated so badly that it fell below the silicone, and then became progressively worse. The tensile strength of the silicone rubber remained unchanged for many days and the elongation was maintained at a usable value. 400F is by no means the upper limit of usefulness of silicone rubber. Many applications demonstrate the successful use of silicone rubber for long periods at 500F.

Fig. 1—Silicone Rubber Insulation Compounds: High Temperature Aging Curves * *

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**The** silicon-oxygen backbone of silicones is extremely resistant to flame. However, the substituent organic groups are combustible. When exposed to direct flame, silicone rubber will gradually burn and leave an ash of silicon dioxide. The latter is electrically non-conducting and, if contained by a glass braid, will serve as an insulator until wiring can be replaced.

**TABLE NO. 2**
**SILICONE RUBBER INSULATION COMPOUNDS**
**TYPICAL PHYSICAL PROPERTIES**

| | |
|---|---|
| Maximum Continuous Operating Temperature | 150 to 200° C (302 to 392° F) |
| Low Temperature Flexibility | —50 to —85° C (—58 to —121° F) |
| Continuous Vulcanization Cure | |
| Tensile Strength, psi | 500 to 800 |
| Elongation, % | 125 to 300 |
| CV Cure Plus 16 hr. at 150° C (302° F) | |
| Tensile Strength, psi | 600 to 900 |
| Elongation, % | 100 to 200 |

### (2) Electricals

**TABLE NO. 3**
**SILICONE RUBBER INSULATION COMPOUNDS**
**TYPICAL ELECTRICAL PROPERTIES**

| | |
|---|---|
| Volume Resistivity, ohm-cm | $10^{14}$ to $10^{16}$ |
| Dielectric Strength, v/mil | 400 to 500 |
| Power Factor | .0035 to .0075 |
| Dielectric Constant | 3.0 to 3.5 |

Note:
(1) Measurements made on .080 in. slabs cured 16 hr. at 250° C (482° F).
(2) Resistivity measured per ASTM D257-46 using potential of 500 volts per mil.
(3) Dielectric Strength measured per ASTM D48-46T, using voltage rise of 1000 volts per second.
(4) Dielectric Constant and Power Factor measured per ASTM D150-47T at 25° C (77° F) 60 cycle, 50% relative humidity.

**As with** physical properties, the general electrical characteristics of silicones should be appraised at operational temperatures as well as under room temperature conditions where properties might be rated good at 25° C (77° F), the rating would be excellent at those extremes where organic rubbers lose all desirable properties.

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**The** dielectric strength remains

relatively constant over the entire range from low to high temperature. Test values of 400-500 volts/mil compare favorably with those of organic elastomers. Fatigue life under continuous stress is high. Organic polymers comparable in initial dielectric strength exhibit far more rapid decrease in this characteristic when subjected to voltage for a prolonged period of time.

★ ★ ★

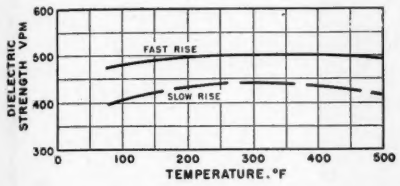


Fig. 2—Silicone Rubber Insulation Compounds: Dielectric Strength vs. Temperature * *

**Insulation** resistance, dielectric constant, and power factor are in the same range as values possessed by organics. These characteristics are influenced by temperature variations. The dielectric constant values shown in Table No. 3 are typical. If extremely high values (8 to 10) are desired, these values can be obtained by proper compounding.

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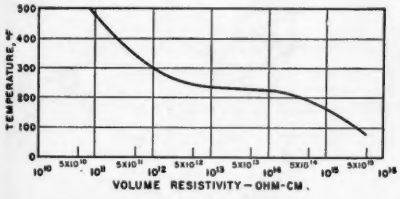


Fig. 3—Silicone Rubber Insulation Compounds: Volume Resistivity vs. Temperature * *

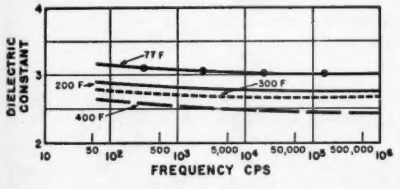


Fig. 4—Silicone Rubber Insulation Compounds: Dielectric Constant vs. Frequency * *

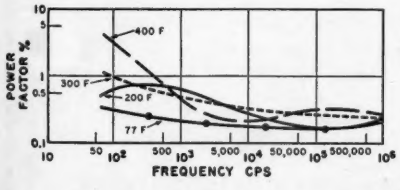


Fig. 5—Silicone Rubber Insulation Compounds: Power Factor vs. Frequency * *

**When** cables are subjected to high voltages, ionization of air occurs and corona and ozone is generated. Organic elastomers are susceptible to attack by ozone, resulting in deep cuts and cracks. Proper compounding will retard this effect. However, silicone rubber stands head and shoulders over organic materials in this respect. In corona resistance, silicone rubber approaches mica and has the added advantage of being flexible.

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**Note:** Natural rubber sample on right cracked badly in seconds—silicone rubber sample on left is still unharmed after many weeks exposure.

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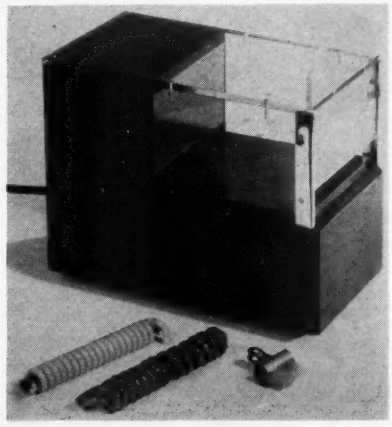

Fig. 6—Ozone Resistance: Silicone Rubber vs. Natural Rubber Insulation * * *

**With** proper choice of fillers and curing conditions, silicone rubber will evidence excellent resistance to moisture absorption. Satisfactory electrical characteristics will be maintained under moist service conditions. Surface breakdown and arc resistance are high.

### (3) Chemical

**Silicone** rubber has good resistance to many oils, solvents and other chemicals. It is affected little by lubricating, animal and vegetable oils; alcohols; chlorinated diphenyls; and most dilute acids and bases. Solvents such as benzene, toluene, gasoline and carbon tetrachloride cause excessive swelling but no permanent damage. When solvents are removed from the rubber, the original physical properties return. The absence of plasticizers and other leachable ingredients is a contributing factor.

## Part III—Applications

**The** wire industry welcomes new materials. Still, there exists the proper amount of conservativeness which demands that new elastomers be exhaustively evaluated prior to their adoption. All new materials require extensive study of properties and processing characteristics. When the material is relatively expensive, developmental costs naturally increase and wire manufacturers tend to be even more cautious.

### (a) Navy Cable

**The** initial impetus was given to silicone rubber as wire insulation by the U. S. Navy, Bureau of Ships, when it modified its communication, control and power cable constructions to incorporate the use of silicones.

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**To permit** the installation of the maximum possible number of cables in fixed wireways on combat vessels, electric cables with reduced diameters were designed. Maximum heat and flame resistance was desired. Silicone rubber possessed the required combination of properties: superior heat resistance and the formation of a non-conducting ash when subjected to a flame.

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**Today,** a number of large wire manufacturers are extruding silicone rubber for this application.

### (b) Ignition Cable

**Insulated** high-tension ignition cable is required for ignition systems for aircraft, ordnance vehicles, and marine service. Since operating conditions will vary, different temperature grades are stipulated. Silicone rubber is used as the insulation for stainless steel conductor designed to operate over the range from 450 to —65° F (232 to —56° C).

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**Organic** elastomers cannot approach the 450° F (232° C) limit. Silicone meets this requirement and that of low temperature flexibility without difficulty. In addition, its excellent dielectric strength enables it to meet the 15 and 20 kilovolt high

(*Please turn to page* 1141)

# IN MEMORIAM

## JOHN A. MORITZ
**1890 — 1952**

**John A. Moritz, President of The Wire Association and Superintendent, Wire Mill, of The Keystone Steel and Wire Company, Peoria, Illinois, died at 11:30 A.M., Saturday, September 27, 1952, at his home in Pekin, Illinois. Mr. Moritz was also Vice President of the Mid-States Steel and Wire Company, Crawfordsville, Indiana, at the time of his demise.**

**A leader in the wire industry, Mr. Moritz was a charter member of The Wire Association and had been one of its Directors since 1941. He was elected its Vice President in 1950 and its President in 1951.**

**Out of an exceptionally broad experience in wire processing, John gave freely and generously of his knowledge to those who sought help. A fine upstanding man of noble character and fine personality, his presence at Wire Association meetings will be sincerely missed. His passing is a personal loss to his host of friends, all of whom regarded him with affection and esteem.**

**John and Sara Zimmerman Moritz were married in Pekin in 1910, where they continued to live. They had two children, a daughter, now Arlene Whitmarsh, who lives in Jacksonville, and John, Jr., who lives in Crete, Illinois.**

# Government Wire Production Information

### Filings by Multi-Unit Corporate Manufacturers

**Certain** multi-unit corporate manufacturers may now apply to the Office of Price Stabilization for permission to file a single report covering operations of the parent company and all its subsidiary company operations in calculating changes in net cost of materials produced in one unit of the business and transferred to another.

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**The** authorization is covered by Amendment 37 to Ceiling Price Regulation 30, effective August 26. The action will permit multi-unit corporate manufacturers to continue their customary accounting practice of treating the entire corporate setup as a single unit in making reports on OPS Public Form 8 as required under Section 44 of CPR 30.

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**Previously,** multi-unit corporate manufacturers have been unable to avail themselves of the procedures provided under Section 26 of CPR 30 for calculating changes in net cost of materials produced in one unit of the business and transferred to another because of the separate corporate existence of several subdivisions of their operation.

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**Under** this authorization manufacturing corporations who own 95 percent of the stock of subsidiary corporations may apply to OPS for permission to file a single report or set of reports as required under CPR 30.

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### Adjustments for Iron and Steel Products

**The** Office of Price Stabilization has issued an order specifying increases in ceiling prices of producers of carbon, alloy, and stainless steel mill products, in accordance with the recent directive of the Office of Defense Mobilization.

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**The** Director of Price Stabilization stated that the directive left the OPS no independent discretion or authority in connection with steel prices.

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**The** increases authorized are based on a total increase equivalent to an average of $5.20 a ton of carbon steel products with a proportionate increase for alloy and stainless steel products. This average increase represents an increase of $2.36 a ton authorized under the ODM directive over the increase of $2.84 permitted under the so-called Capehart amendment to the Defense Production Act.

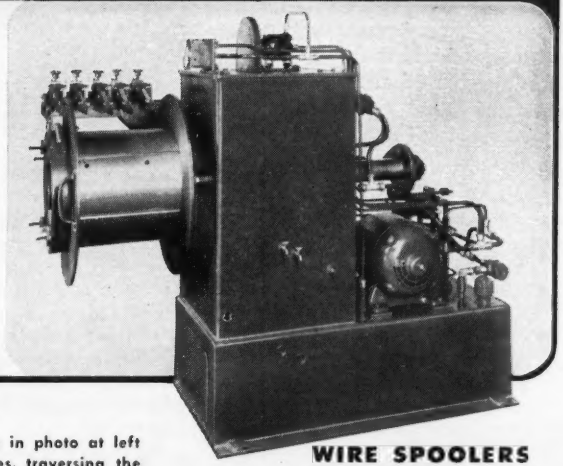
★ ★ ★

**The** increases are being authorized for producers who established ceiling prices under the General Ceiling Price Regulation (GCPR) and also for those producers who established ceiling prices under the voluntary agreement with OPS. Under the voluntary agreement certain producers agreed to maintain

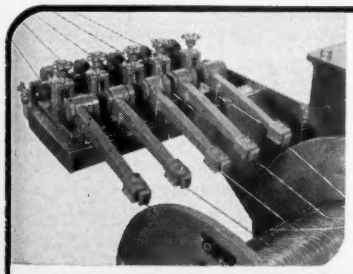

COIL 5 STRANDS IN 1 OPERATION

SECO TRAVERSE REEL SPEEDS UP PRODUCTION

This new SECO Traverse Reel winds five separate coils of flat wire or narrow strip *at the same time.* Coils are oscillated-wound, permitting much longer lengths than conventional ribbon-wound coils. Smooth, powerful hydraulic operation gives coiling speeds as high as desired, accurately controlled from zero to top running speed.



WIRE SPOOLERS
Single and Multiple type. Speeds up to 4,000 feet per minute.



Method of coiling is shown in photo at left The complete block oscillates, traversing the wire into five 3" wide coils. Traverse and tension control are extremely accurate. 1/8" to 1/2" wide flat wire can be wound. Block has 16" inside diameter and 24" outside diameter.

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***1800 feet an hour***

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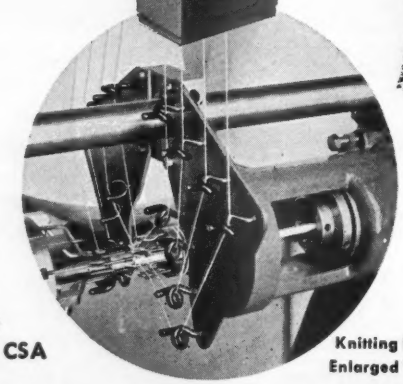
Model C-3H Knitter & Haul-Off Reel Stand

★ Increase speed 10-15 times
★ Save on cost of yarn
★ Boost labor output 600%
★ Eliminate yarn rewinding
★ Conserve floor space
★ Cut maintenance costs
★ Reduce power requirements
★ Minimize operating noise
★ Improve working conditions
★ Provides automatic control
★ Lower your capital investment
★ Approved by UL, ASA, AAR, CSA



Knitting Head Enlarged View

This *Fidelity Sinfra* Wire Covering Machine offers you high production speed and low operating cost. The output of *one* Knitter equals 15 conventional machines. Savings in yarn costs and direct labor alone pay for this new equipment in 12 to 24 months. Knit products are universally used and meet all standards.

The modern Fidelity Sinfra method uses fewer yarns and large 3 pound cones located on a stationary creel. High-speed, rotating Knitting Heads cover the wire at 30 or more feet per minute. Design permits horizontal operation at convenient working level with no crawling or stretching. Automatic electric stop motions and other advanced features cut maintenance and down time.

To see why top companies choose Fidelity, read our literature proving its advantages. Write today for Catalog W.

Manufacturers of intricate precision machinery since 1911

**FIDELITY MACHINE COMPANY INC.**

**3908 FRANKFORD AVE. • PHILADELPHIA 24, PA.**

prices which they had in effect in January 1951.

★ ★ ★

**Permissible** increases are spelled out product by product on a dollars-and-cents basis or on a percentage basis applied to established ceilings.

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**OPS,** with the cooperation of the General Steel Products Industry Advisory Committee, has determined dollars-and-cents increases for carbon steel and certain alloy steel products by applying the $5.20 a ton increase on a basis proportional to the man-hours required in the production of each product. Under this technique a product with a low number of man-hours is given an increase of less than $5.20 a ton and a product with a high number of man-hours is given an increase of more than $5.20 a ton. However, the increase for all carbon steel and certain alloy steel products on a dollars-and-cents basis will average out to $5.20 a ton.

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**A proportionate** increase is authorized for alloy and stainless steel and certain carbon steel specialties. By relating the increase of $5.20 a ton to the average realization on carbon steel of $110.38 a ton, this proportion was determined to be approximately 4.7 percent. Because of the large number of individual products included in the categories of alloy and stainless steel and certain carbon steel specialties, it is deemed appropriate to permit producers of these products to increase ceiling prices by the percentage indicated.

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**It is** contemplated that a further review and modification of some of these prices may be undertaken by OPS.

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## August Technical Reports Newsletter

**Several** new products and new processes made availabe to U. S. industry as a by-product of defense research are discussed in the August Technical Reports Newsletter now available from the Office of Technical Services of the U. S. Department of Commerce.

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**The** new developments discussed include: 1) a non-corrosive solder for difficult-to-solder metals such as

steel and aluminum; 2) a new process for bonding metals to ceramics which makes possible better degassing of electronic tubes, and better metal cutting tools; 3) new extinguishing fluids which make portable fire extinguishers more effective. Also reported in this issue of the *Newsletter* is a process for mass-production of high voltage dry-disc electrical rectifiers.

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**In addition** there are reviews of pamphlets which bring the shopman up to date on latest techniques for alignment of machine tools, sharpening of drills and cutting tools, and the care and maintenance of belt, chain and gear drives.

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**One** interesting item in this *Newsletter* cites the patents and technical information available from the Federal Government to help manufacturers interested in developing aerosol-bomb containers for shaving creams.

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**Single** copies of the August, 1952 Technical Reports Newsletter are available without charge from the Office of Technical Services of the U. S. Dept. of Commerce, Washington 25, D. C. or from the U. S. Department of Commerce field offices.

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## Bibliography of Technical Reports

**Valuable** technical advances for the metallurgical, plastics, electronics and construction industries are described in the August issue of the Bibliography of Technical Reports, now available from the Office of Technical Services of the U. S. Department of Commerce.

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**Featured** in this issue are reports on: A new (fluorethylene) type of plastic material which makes more durable insulation for electric wires; fiberglass reinforced plastic fuel tanks; thermal deleading of gasoline; a magnetic oxygen meter; high frequency heating and surface hardening of steel; research on the upper atmosphere by rocket-borne electronic instruments; centimeter-wave radio telescope; frost action in soils; a study of conservation in building construction and fundamental studies of chemical retardants for fire resistant treatment of textiles.

★ ★ ★

THESE 4 Solar COMPOUNDS ARE "Conditioned" for conditions!

BECAUSE both the angle of the glass braid, particularly on building wire and armored cable conductors, and the temperature conditions encountered during shipping, warehouse storage and installation have a direct bearing on the particular types of saturants and finishers used, it is important to your company that you are aware of the qualifications of various compounds.

Solarite KS-566 Saturating and KF-561 Finishing Compounds—used over all glass braided, rubber covered wire and non-metallic sheathed cable—are specifically designed to meet stringent conditions. They provide excellent moisture resistance, retain flexibility at low temperatures and prevent sticking in coils at extremely high temperatures.

For more normal conditions where extremities are not likely to be encountered, it is more practical and less expensive to apply Solarite KS-709 Saturating and KF-715 Finishing Compounds. These materials have excellent tank stability, operating characteristics and flame retardant qualities.

SPECIFICATIONS

| Solarite KS-566 Saturating Compound | | Solarite KS-709 Saturating Compound | |
|---|---|---|---|
| Softening Pt.—(B & R)... | 140°F. Min. | Softening Pt.—(B & R)... | 120°F. Min. |
| Penetration @ 77°F., 100 gr., 5 Sec..... | 60-75 | Penetration @ 77°F., 100 gr., 5 Sec..... | 44-55 |
| Stormer Viscosity @ 300°F. 100 Revolutions..... | 85-110 Sec. | Viscosity, Stormer @ 300°F., 100 Revolutions | 28-34 Sec. |
| Specific Gravity @ 25°C. | 1.00-1.04 | Specific Gravity @ 25°C. | 1.02-1.06 |
| Flash Pt..... | 500°F. Min. | Flash Pt..... | 530°F. Min. |
| Fire Pt..... | 600°F. Min. | Fire Pt..... | 600°F. Min. |

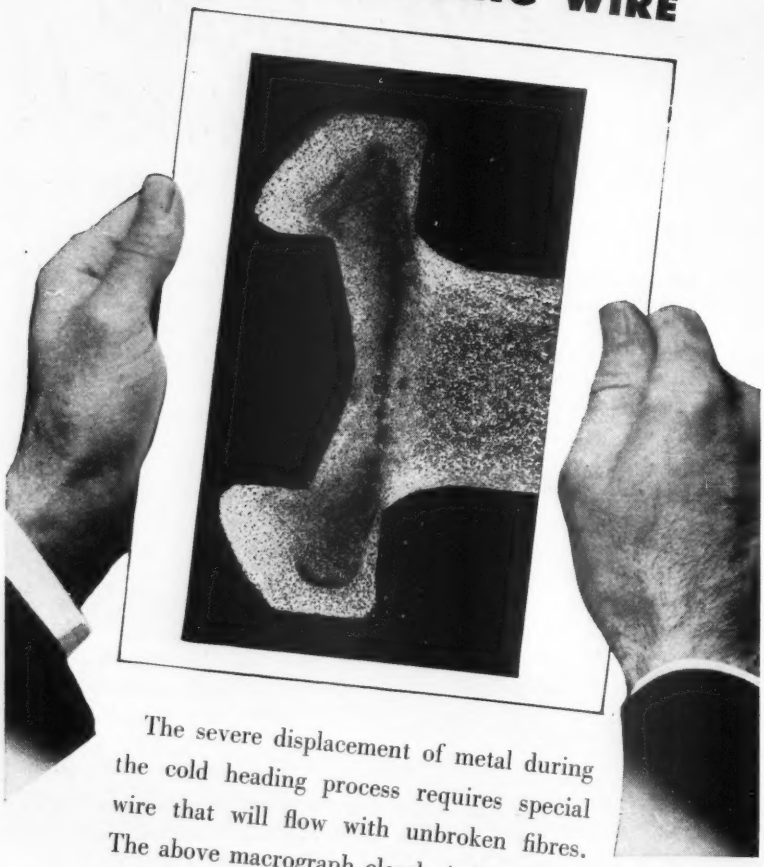
| Solarite KF-561 Finishing Compound | | Solarite KF-715 Finishing Compound | |
|---|---|---|---|
| Softening Pt.—(B & R)... | 220°F. Min. | Softening Pt. (B & R).... | 200°F. Min. |
| Penetration @ 77°F., 100 gr., 5 Sec..... | 14-16 | Penetration @ 77°F., 100 gr., 5 sec..... | 7-10 |
| Viscosity, Stormer—360°F. | 3-10 RPM | Viscosity, Stormer—36°F. | 5-12 R.P.M. |
| Specific Gravity @ 77°/77°F..... | 1.02-1.06 | Specific Gravity— 77°F/77°F..... | 1.02-1.06 |
| Flash Pt..... | Over 500°F. | Flash Pt..... | 500°F. |

Note: Regardless of what combination is used, it is important that paint be used as an anti-stick.

*The services of our technical staff are available to you without obligation.*
*For additional information, write Solar Compounds Corporation.*

Solar Compounds Corporation
Solar Varnish Corporation
1213 WEST BLANCKE ST. · LINDEN N. J.

# KEYSTONE
"SPECIAL PROCESSED"
## COLD HEADING WIRE



The severe displacement of metal during the cold heading process requires special wire that will flow with unbroken fibres. The above macrograph clearly indicates the excellent grain flow in a recessed-head screw made from Keystone "Special Processed" C-1012 Cold Heading Wire.

**Keystone's "Special Processed" Cold Heading Wire is available in C-1035 and C-1038 analysis for high strength, heat treated screws and bolts.**

INDUSTRIAL WIRE SPECIALISTS

**Keystone Steel & Wire Company**
**PEORIA 7, ILLINOIS**


**In all,** 278 reports are listed from the laboratories of the Federal Government, from industrial and university laboratories working for it, and from foreign government and other non-confidential sources. Most of these reports are not otherwise published.

★ ★ ★

**A variety** of technical fields are covered: Chemicals; pharmaceuticals; plastics; electrical machinery; electronic equipment; food and kindred products; fuels and lubricants; instruments; machinery; medical research and practice; metals and metal products; meteorology and climatology; minerals and mineral products; photographic and optical goods; structural engineering; textiles and textile products; aeronautics; aircraft; aerodynamics; also water supply and sanitation.

★ ★ ★

**The August,** 1952 issue of the *Bibliography of Technical Reports* sells for $.50 a copy, (yearly subscription rate of $5.00 includes the Newsletter) and may be purchased from the Office of Technical Services of the U. S. Department of Commerce, Washington 25, D. C. or through the U. S. Department of Commerce field offices. Orders should be accompanied by check or money order payable to the Treasurer of the United States.

★ ★ ★

### DMPA Arranges for More Copper

**The** signing of a floor-price purchase contract for copper and molybdenum with the San Manuel Copper Corporation, of New York, has been announced.

★ ★ ★

**The** action completes the Government's negotiations for development of the company's vast copper and molybdenum holdings in Pinal County, Arizona. The property contains one of the largest copper deposits ever discovered in the United States.

★ ★ ★

**A loan** of $94,000,000 to assist in development of the property was approved recently by the Reconstruction Finance Corporation.

★ ★ ★

**DMPA** has guaranteed the company a market for 365,000 short tons of electrolytically refined copper and 16,060 short tons of molybdenum

contained in concentrates. The guaranteed price for the copper is 24 cents per pound, ½ cent under the present ceiling, and 60 cents per pound for the molybdenum concentrates.

★ ★ ★

**As in** the other floor-price purchase contracts negotiated by DMPA for strategic materials, the Government has an option to purchase the company's total output upon advance notification. It is expected, however, that most of the company's output will be sold directly to industry, Mr. Larson said.

### Proposed OPS Work Program

**The** price stabilization program to be followed in the next several months has been tentatively mapped out and was made public August 28th by **OPS** with the approval of the Economic Stabilization Agency.

★ ★ ★

**The** program is designed to permit the agency to marshal its curtailed forces in a way that will best carry out basic stabilization objectives. It takes account of current economic conditions, as well as limitations on time, funds and authority imposed by the amended Defense Production Act and Congressional appropriations.

★ ★ ★

**The** outline also makes provision for "recent special price increases made without regard to **OPS** standards." It says:

"**Recent** steel, copper and aluminum increases will be passed through the economy without absorption or pyramiding except where required by law.

★ ★ ★

"**Outbound** freight cost increases will also be passed on by sellers on a delivered price basis.

★ ★ ★

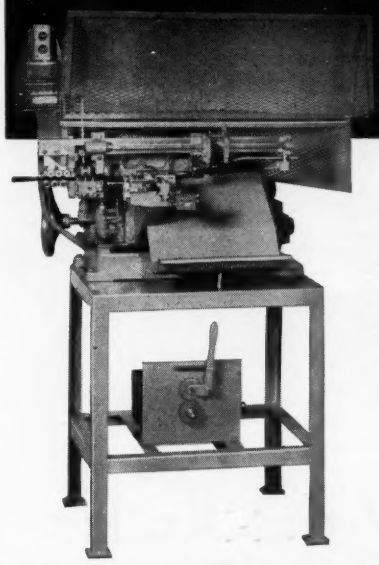
"**The** extent of any pass-through of other cost increases will be judged in terms of present **OPS** pricing standards."

★ ★ ★

**To meet** "the heavy administrative burden of applying present pricing standards in the face of recent and prospective wage and other cost increases," the agency said "interim adjustments" will be used. They will be based, it said, on data already available or quickly obtainable.


# *How to* CUT AND STRIP INSULATED WIRE...

as fast as 3000 lengths per hour



## MODEL CS-6E CAPACITY

**Finished Pieces Per Hour**—15 in. lengths, 3000 per hour; 97 in. lengths, 500 per hour.

**Maximum Stripping Length**—1½ in. at each end.

**Maximum Cutting Length**—97 in.

**Minimum Cutting Length**—2 in. (⅞ in. special).

**Wire Handled**—Solid or stranded single conductor wires, parallel cord, heater cord, service cord, etc.

**Maximum Wire Size**—No. 10 stranded or No. 12 solid.

### *Other Artos Machines*

The complete line of Artos automatic wire cutting and stripping machines will handle *cut lengths* from 1 in. to 60 ft., *stripped lengths* to 6½ in. at one end and 8½ in. at the other, *wire* from No. 12 to No. 000 gauge, and up to 3600 pieces per hour. Ask for recommendations on your own specific problems.

## ARTOS Automatic MACHINES REDUCE TIME AND COST

For quantity production of finished wire leads . . . measured, cut to length, and stripped at one or both ends . . . investigate Artos Automatic Machines.

The Model CS-6 illustrated can complete up to 3,000 pieces per hour in 15-in. lengths, and other lengths in proportion. You save through combined operations . . . through quick, easy set-up . . . through unskilled help who can handle this machine. You obtain substantial time savings over the best manual or semi-automatic methods.

Highly accurate machine operation reduces work spoilage to an absolute minimum — errors due to the human element are eliminated. There is no cutting of strands or nicking of solid wire. Uniform lengths and uniform stripping are produced consistently.

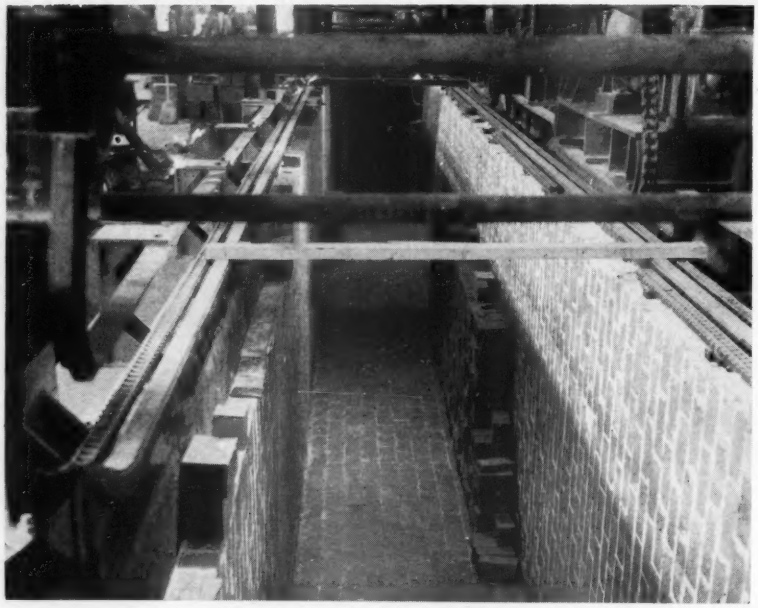
## WRITE FOR BULLETIN

Get the complete story—write now for Bulletin 35-C on Artos Model CS-6 machines.

*Automatic Wire Cutting and Stripping*

**ARTOS ENGINEERING CO.**

**2753 S. 28th St. • Milwaukee 46, Wis.**



Pyroflex Tank Under Construction

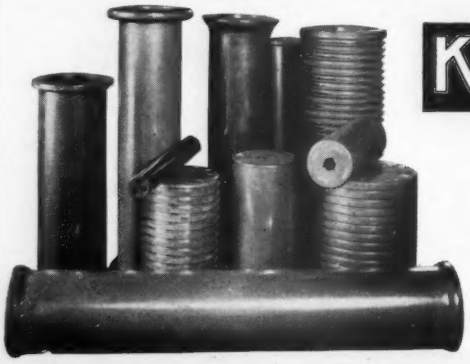
# Corrosion-Proof Rolls and Processing Tanks

Pickling and plating tanks which are acid-, alkali- and leak-proof are available of Pyroflex Construction. These are steel tanks lined with suitable corrosion-proof materials to best meet your particular operating conditions.

Knight-Ware corrosion-proof wire and sheet rolls or sinkers are made to meet customers' needs. You can choose the diameter, groove spacing and length to fit your operation. They are entirely acid-proof and hard with no coating or shell to depend on for acid resistance or wear.

Knight engineers welcome your inquiries on wire rolls and Pyroflex processing tanks. Be sure to give them as complete data as possible regarding the character and purpose for which this equipment is to be used.

*Literature will be sent on request.*



KNIGHT-WARE CHEMICAL EQUIPMENT

**MAURICE A. KNIGHT**
**44 Kelly Ave., Akron 9, Ohio**

*Knight-Ware Wire and Sheet Rolls or Sinkers Are Made to Fit Your Operations.*

**In** general, the program calls for the agency:

1. **To go forward with a positive program of controls where required by economic conditions and where permitted by law.**
2. **To improve the administration of controls that are continued, with a minimum burden on business.**
3. **To limit ceiling price increases to those required by law or by fairness and equity, and to reduce established ceiling prices where "appropriate and clearly justifiable."**
4. **To suspend controls which are not currently serving a useful stabilization function.**
5. **To make plans to meet any new inflationary crisis that may occur.**
6. **To improve food price controls.**

★ ★ ★

**OPS** Director Ellis Arnall emphasized that the program has not been adopted in final form. The draft is being studied by **OPS** commodity division directors and other agency officials and is subject to further modifications. Its general objectives, however, have been accepted by stabilization authorities, including Roger L. Putnam, Administrator of **ESA**, and Tighe E. Woods, the incoming Director of **OPS.**

★ ★ ★

**Once** the program has been finally approved, all units of the agency will draw up specific programs to carry out these basic objectives in their own fields.

★ ★ ★

## Alloy Steelmaking Gains Faster Than Alloy Use

**The** manufacture of alloy steels rose 18 per cent to more than 10 million tons of ingots and castings, and the consumption of alloying elements rose 16 per cent to 418 million pounds during 1951 as compared with the preceding year. Alloy steel manufacture, highest since 1944, increased more than the consumption of alloying elements partly because of the leaner alloy content of steel made possible by the use of boron. Nevertheless, higher amounts of chromium, cobalt, columbium, molybdenum, titanium and vanadium were consumed in steelmaking furnaces in 1951 than in any other postwar year.

★ ★ ★

**During** 1951 the quantity of boron used as an alloying element in the manufacture of steel was reported for the first time. About 132,000 pounds was used to make 354,000 tons of "boron steels," an average

of about one pound of boron for every 2½ tons of steel made with it. Boron is the most recent of the alloying elements to come into prominence. Its use affects the hardenability of steel, conserving other, more critical elements used for the purpose in some cases.

★ ★ ★

**The** use of vanadium rose 81 per cent last year over the 1950 amount, to 3.3 million pounds. Chromium consumption, totaling 305 million pounds, increased 23 per cent over the previous year's consumption. The use of cobalt totaled 2.6 million pounds, or 26 per cent more than in 1950.

—from Steel Facts #115

### New Talon Plant to Be Built in Georgia

**Talon, Inc.,** has announced that it has broken ground for a new metal fastener plant at Cleveland, Ga. The building will be one-story and will cover 17,000 square feet of floor space. The plant is expected to employ about 150 persons and will make various fastener products.

★ ★ ★

### ISA Program for Instrument Mechanic Training Now Available

**Just** released by the **National Office of the Instrument Society of America** is a sixty page detailed outline for operation of an Instrument Mechanic Training Program. Entitled "Industrial Instrument Training Course Outline", the heavy paper bound publication covers such aspects of a training program as selection of mechanic personnel, instructor's suggestions, physical equipment, reference books and films, and a detailed outline of training material according to subject.

★ ★ ★

**The** material for this outline was collected and edited by sixteen leading industrial instrument engineers and maintenance supervisors as members of the Instrument Society of America's Sub-committee on Instrument Mechanic Training. More than a year was spent by the committee members in compiling this outline.

★ ★ ★

**It is** available to the public as a guide to the operation or establishment of an instrument mechanic training program. It is designed to

specify
SENECA
ROUND AND FLAT
SPRING WIRE

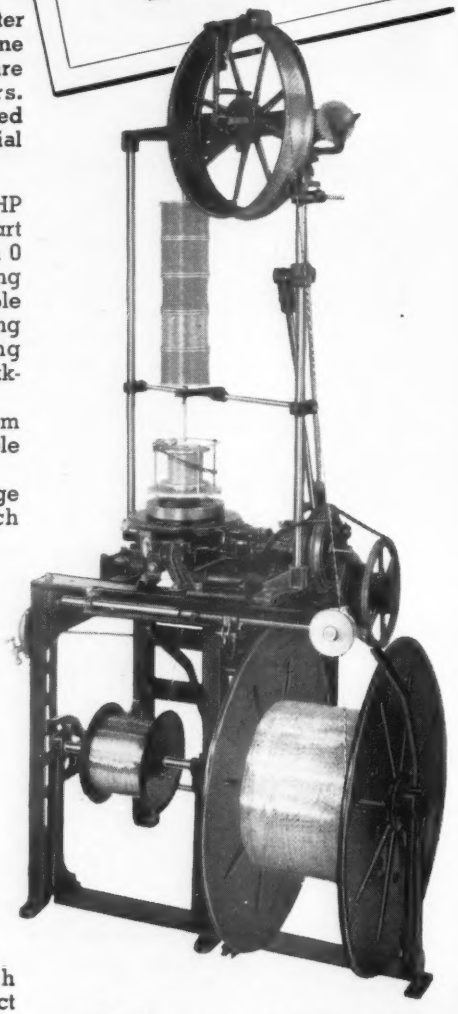
Whatever your spring wire requirements—consult with Seneca! Our production *geared to precision* in manufacturing oil tempered and hard drawn wire—round and flat—for all types of high grade mechanical springs. You'll find that Seneca uniformity and dependability help the spring manufacturer produce high quality springs at low cost. Make Seneca your headquarters for all needs in Quality Wire.

Seneca
WIRE & MFG. COMPANY • FOSTORIA, OHIO
*Representatives in practically All Principal Cities*

# A NEW VERSATILE SERVER

## WARDWELLIAN P-C SERVING MACHINE

**For applying small diameter filaments such as polyethylene and materials of a similar nature on electrical conductors. Machine is especially adapted for the production of coaxial wires.**



- Machine driven by a ½ HP Graham Transmission to start at head speeds ranging from 0 to 2000 RPM. Permits starting operation at any speed suitable for type of material being served, thereby eliminating stretching and avoiding breaking material.
- Manual control for Graham Transmission readily accessible at front of machine.
- Standard set of five change gears furnished with each machine.
- Machine equipped with electric stop-motion.
- Production dependent upon requirements: 4912 feet per hour for applying material at ½" lay.
- Supply tube holds five spools.
- Supply spools made in halves to permit removal without cutting wire.
- Seven supply spools furnished with machine.
- Capstan 18" diameter, 3" face.
- Opening through serving head, 3/16" diameter.
- Machine equipped with counter for measuring product in feet.
- Stand will accommodate reel 30" in diameter with 13" overall width.
- Special windup parts required for reels with drums under 8" in diameter.
- Reels not included with machine.
- Weight approximately 664 lbs.
- Weight crated for domestic shipment approximately 764 lbs.

**WARDWELL**
BRAIDING MACHINE CO.
Central Falls
Rhode Island, U.S.A.
*Representatives for Europe, British Colonies and Dependencies*
JAMES MACKIE & SONS, LTD., BELFAST, IRELAND


offer detailed programs covering fundamentals of mechanics and electricity, theory and practice in operation and maintenance of electrical, mechanical, pneumatic, hydraulic, and electronic instruments. Instruments for measuring and controlling such variables as temperature, pressure, flow, and level are covered. Automatic control instruments, valves, time cycle instruments, combustion control and many other subjects are included in the outline.

★ ★ ★

**The** booklet has been specially priced at 75¢ to ISA Members and $1.50 to Non-Members. Copies may be secured at the Instrument Society of America, 1319 Allegheny Avenue, Pittsburgh 33, Pennsylvania.

### Alloy Rods Company to Feature Movie at Metal Show

**First** showing of a new 22-minute motion picture in full color and sound, revealing the "inside story" on how arc welding electrodes are manufactured, will be held at the National Metal Exposition in Philadelphia, October 20-24, by the **Alloy Rods Company** of York, Pennsylvania as the central feature of their exhibit in Booth #448.

★ ★ ★

**Entitled** "No Finer Electrodes Made . . . Anywhere," the film was made professionally in the Alloy Rods Company's plant at York and will be exhibited every hour on the hour at the Metal Show.

★ ★ ★

**According** to company officials, this film is not a typical "sales movie" or promotional device, but was purposely photographed and edited to be an instructional and technical pictorial story intended mainly for showing before welding societies, engineering groups, metalworking industry organizations, college and university classes, and others interested in arc welding techniques. It comprises about 45 scenes "shot" on the Alloy Rods Company production lines, and is believed by the company to be the first pictorial story of the manufacture of alloy arc welding electrodes showing actual manufacturing processes, procedures, and research close-ups. These matters, it is said, have always been carefully guarded trade secrets heretofore.

★ ★ ★

**After** its premiere at the Metal Show, 16 millimeter prints of the entire movie will be made available to any reputable organization or group which desires to show the film. Arrangements may be made by writing Department M of Alloy Rods Company, York, Pennsylvania. In addition to the film, the company has published a 24-page brochure (Bulletin AR52-7) showing the key "stills" of the picture for distribution to viewers and other interested parties.

★ ★ ★

### Steel and Nickel Alloys Being Extruded

**The** first Extrusion Installation in the United States for hot forming of Steel Shapes by the Ugine-Sejournet Process—using Glass as a Lubricant—was designed and built by **Hydropress, Inc.**, of New York. The machine which has a capacity of 2,500 Tons is in successful operation at The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa. Prior to extrusion of tubular shapes the billets are pierced on a Loewy-Hydropress-built Hydraulic Piercing Press of 500 Tons capacity.

★ ★ ★

**Another** 2,500 Ton Loewy-Hydropress Extrusion Installation for manufacturing Steel Shapes by means of the Glass-Lubrication Method will go into operation shortly while two others of 1,000 Ton and 1,650 ton capacities are under construction.

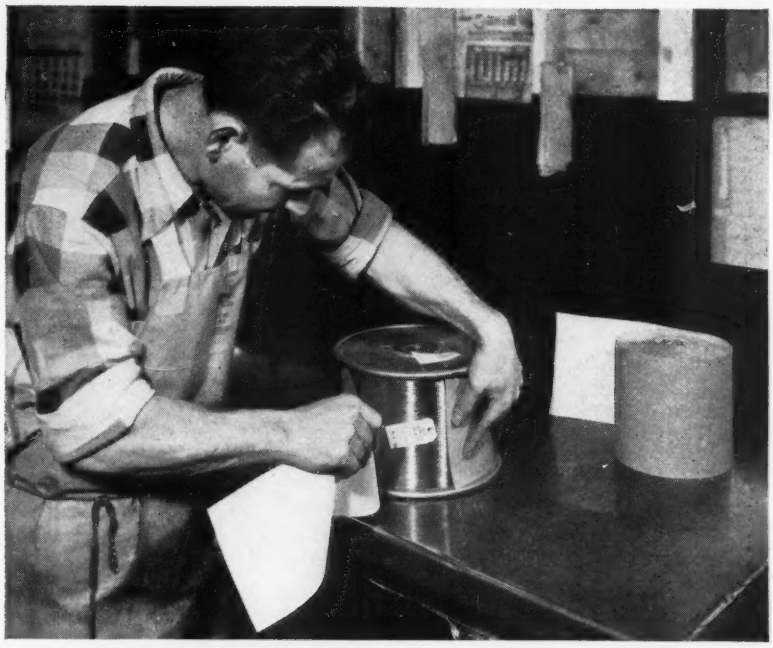
★ ★ ★

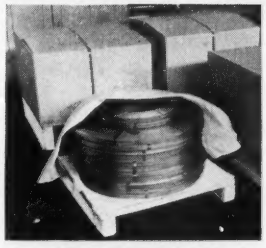
**Over** a period of ten years many successful trials have been made on Hydropress equipment in the extrusion of Steel and High Nickel Alloys. In fact, Tubes of Nickel, Monel and Inconel have been manufactured commercially since 1943 on a 4,000 Ton Extrusion Press supplied by Hydropress to The International Nickel Company Plant in Huntington, Virginia.

★ ★ ★

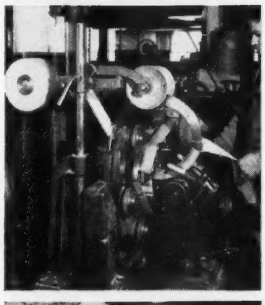
**A** Steel Extrusion Press of the tremendous capacity of 12,000 Tons is being built now by the Loewy Construction Company, a subsidiary of Hydropress, Inc., for the Heavy Press Program of the United States Air Force.

★ ★ ★

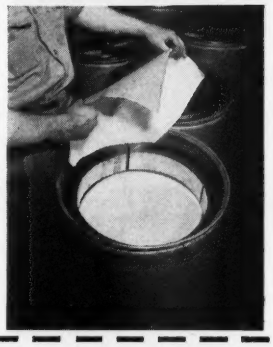





VPI shroud — no oil or goo used.



Angier VPI peripheral wrap



VPI Wrap used as an insert.

*Vapor from paper*
STOPS RUST

Simple as it seems, this Angier paper is merely placed near metal to *prevent rust*. It gives off a vapor that makes air and moisture harmless to steel.

Angier VPI® Wrap makes coating with oil or goo a needless chore. All "cleaning" costs are saved. Metal stored or shipped with VPI always is ready for instant use . . . what *sales appeal* for your products! Rejects due to rust are eliminated.

If *your* products must be guarded from rust (for days or *years*) send the coupon now for facts.

Angier

DISTRIBUTORS IN PRINCIPAL CITIES

**The Most Experienced Name in Vapor Rust Preventives**

**Angier Corp., Framingham 3, Mass.**

**Name** .....

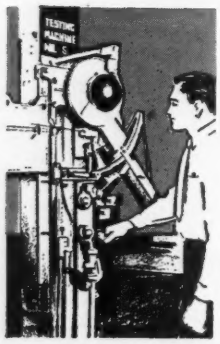
**Title** .....

**(Clip this to your letterhead)**

( ) **Send "VPI Facts" as applied to shipping or storing wire and steel.**

( ) **Send facts on Angier spiral wrapping machines.**

**UNLIMITED!**



Johnson XLO Music Wire, "the wire of a thousand uses" —high-grade springs and wire forms difficult of formation. Johnson makes this wire better in order that your products may be better. Where service required is exacting, you can depend on Johnson XLO Music Wire.

*"Johnson Sets the Standard of the Industry"*

**JOHNSON**

**JOHNSON STEEL and WIRE CO., INC.**

**Worcester 1, Massachusetts**

SUBSIDIARY OF PITTSBURGH STEEL COMPANY


## New American Brass Mill Nearly Completed

**The American Brass Company's** new wire mill at Ansonia, Connecticut, is one of several major programs, all of which are designed for increased production efficiency, superior control of product, greater capacity, and improved earnings.

★ ★ ★

**The** Ansonia wire mill utilizes an existing structure, re-equipped with the most modern production facilities. New machinery includes an improved hot rod mill, fifteen high speed wire drawing machines and continuous annealers, an electrolytic plant for reclaiming copper and acid worth $30,000 per year, also new trimming machines, die making equipment, cable stranding units, and five ultra-modern flat wire rolling machines.

★ ★ ★

**For** this mill, expenditures to date have been approximately $3,300,000, representing 89% of funds appropriated for the project. On completion of the program this year, estimated saving over previous operating costs will be very substantial.

★ ★ ★

## To Package Diamond Abrasive In Plastic Cartridge

**After** more then a year of experimental and development work, the **Abrasives Division of the Elgin National Watch Company,** Elgin, Illinois, has announced a new plastic cartridge to replace glass cartridges formerly used for packing the company's diamond abrasive, DYMO. The cartridge is a precision tube, sealed at both ends, designed for use with applicator guns.

★ ★ ★

**Basic** advantage of the new plastic cartridge over glass is decreased chance of contamination of the contents of the cartridge. With the old glass cartridge, there was danger of introducing minute glass chips to the abrasive when the cartridge was opened and inserted into the applicator. These chips in turn, caused scratches during polishing operations. Further advantages of the plastic cartridge is that it will not break or crack if accidentally dropped.

★ ★ ★

**The** new plastic cartridges will be available in both 5 and 18 gram sizes and will not interfere with the familiar Elgin color system for abrasive grade identification. For further information, address inquiry to Abrasives Division, Elgin National Watch Company, Elgin, Illinois.

### Data Sheets Tell How to Use Aluminum Conductors

**The** urgent need for greater understanding in the use of aluminum electrical wire and cable prompted **Thomas & Betts Company**, Elizabeth 1, N. J., to publish a series of data sheets enclosed in a folder entitled, "Making Good with Aluminum." It is pointed out that aluminum electrical conductors cannot be handled like those made out of copper and that recommendations must be made with careful consideration of specific job requirements.

★ ★ ★

**Five** important aluminum characteristics are listed and discussed in detail—conductivity, oxide coating, susceptibility to mechanical damage, expansion and contraction due to temperature change and electrolytic action. The data sheets tell what to do about them when connecting aluminum wire and cable.

★ ★ ★

**A table** gives current-carrying capacities for aluminum conductors from size #8 to 2000 MCM. Proper methods for removing insulation and cleaning and connecting aluminum cables are illustrated. Drawings also explain the principle and installation of T & B Method compression connectors.

★ ★ ★

**The** data sheets list specifications for compression and hinged aluminum connectors: lugs, parallel taps, two and three-way connectors, compression tension splicers, compression dead ends, compression jumper splicers and repair sleeves for ACSR conductors.

★ ★ ★

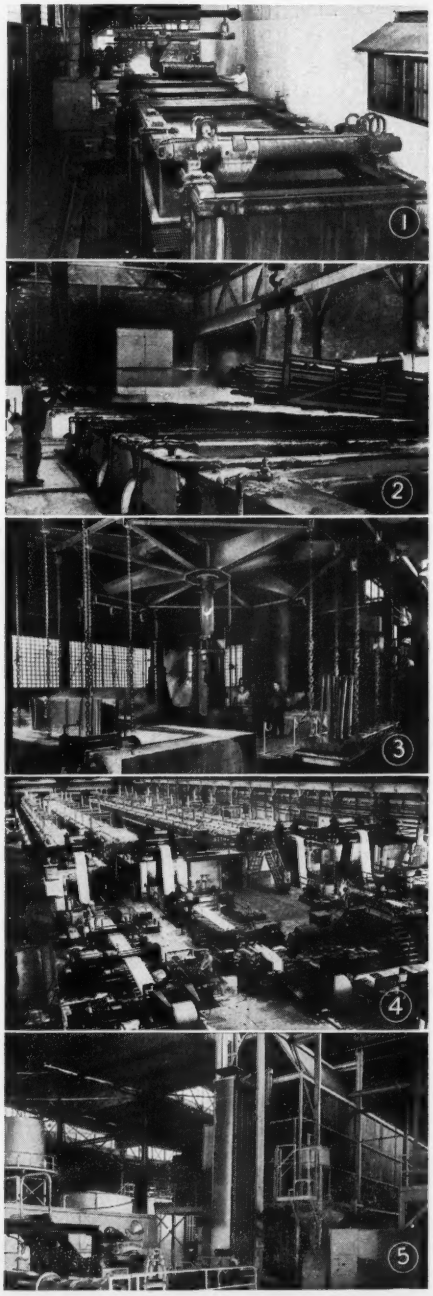
**According** to **M. D. Bergan**, the company's director of research, performance of aluminum cable will equal that of copper, if it is handled as recommended by reputable connector suppliers.

★ ★ ★

**Copies** of "Making Good with Aluminum" are available from the Sales Department of the company at the above-given address.


AMERICAN CHEMICAL PAINT COMPANY
AMBLER CHEMICALS ACP PROCESSES PENNA.

Technical Service Data Sheet
Subject: EFFICIENT PICKLING
WITH RODINE®



1. Rod and wire are pickled clean with "Rodine" without wasting either acid or metal. Breakage in drawing due to acid brittleness is minimized.

2. "Rodine" protects the exterior of tubes while completely descaling the interior and minimizes breakage in drawing due to acid brittleness.

3. "Rodine" makes possible the batch pickling of sheets over a wide range of acid concentration and temperature.

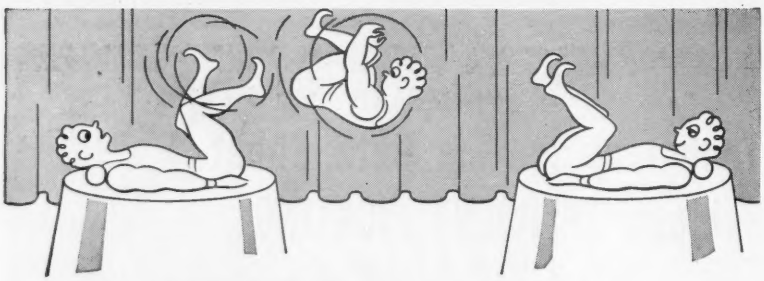
4. Whether sheet steel is pickled continuously or in batches, "Rodine" improves the surface and prevents "pickle burning" in prolonged pickling.

5. The absence of pitting and the smoother surface obtained with "Rodine" saves expensive coating metal in electrolytic tinning and galvanizing.

CHEMICALS ACP PROCESSES

WRITE FOR DESCRIPTIVE FOLDER ON "RODINE" AND INFORMATION ON YOUR OWN PICKLING PROBLEM.

CHEMICALS ACP PROCESSES



Put some spring in your assembly!

see the man with a

**Versatile Torrington Spring Coiler**

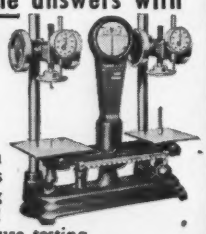
In spring coiling, the words "Torrington" and "Versatile" are synonymous! When you desire springs produced to meet exacting requirements, just call the professional springmaker who has a Torrington coiler. He's the man who can fill your needs with accuracy, speed and economy. On special springs, our sales department will gladly assist you in finding a source of supply, or help your springmaker devise just the right tooling to produce it.

Torrington's 14 different Spring Coilers cover a range of wire diameters from .003" to .750"

MODEL W-11 SPRING COILER

Wire diam. range: .015" to .072". Length per spring: 0" to 42". O. D. Coil Range: 3/32" to 1 9/16". Produces 23 to 190 springs per minute with variable speed drive. Extra wire feed gears, torsion, other attachments available.

NOW... Spring Makers and Users can get the same answers with The TORRINGTON SPRING TESTER



An accurate, uniform and inexpensive means of measuring spring load and deflection! For inspection or in-use testing . . . to aid in designing and developing springs for specific uses or as a basis for statistical quality control. Write today for illustrated bulletin on the Torrington Spring Tester!

The TORRINGTON MANUFACTURING COMPANY TORRINGTON, CONNECTICUT

## Booklet on Research Issued by Battelle

**The Battelle Memorial Institute,** Columbus 1, Ohio, has issued a 16-page booklet on their research work in engineering economics. With the objective in mind that research has failed in its purpose if products are not developed that can be marketed profitably, the booklet outlines its facilities for conducting research along lines that will result in practicable recommendations to the industrialist. This covers supply and demand, competition, costs, selling prices, materials and many other aspects of making and marketing products. Full details are given in the booklet, which will be mailed upon request to interested concerns.

## Alcoa Planning New Smelting Mill

**Aluminum Company of America** (ALCOA) will undertake the construction of a 400 million dollar aluminum smelting project in Alaska as soon as the necessary land can be purchased and government approvals obtained, the company has announced.

★ ★ ★

**The** Alaskan smelting facilities, and electric power developments necessary to operate them, would be situated in the Taiya Valley district, near Skagway, Alaska. Financing of the project would be done entirely with private capital, Mr. Hickman said.

★ ★ ★

**The** project would be the largest in Alaska to provide employment every day of the year, and is expected to be a great step forward in the industrial development of the territory.

★ ★ ★

**The** Taiya development will require about four years for completion and eventually will offer employment for approximately 4,000 people when full scale operations get under way, and will be capable initially of producing 200,000 tons of aluminum annually.

★ ★ ★

## Interim Rust Prevention, Combined with Barrel Deburring

**The Magnus Chemical Company,** Garwood, N. J., announces a novel new use of its temporary rust preventing material, Magnus 26N,

which has a broad field of application.

**Magnus 26N** is a mildly alkaline material (with a pH just over 8), used to provide temporary protection against rusting on steel parts. Work is simply dipped into a hot solution of 26N, containing from ¼ to 1 ounce per gallon of water, depending on the individual application. On the large pieces, if the work is immersed in this solution for 2-3 minutes, there will be enough residual heat in the work to make it self drying. On small pieces, while residual heat will help, air blast or some other means of drying will be necessary. In any case, Magnus 26N leaves a practically non-visible protective film which will continue to prevent rusting as long as it remains. It is readily removed by a simple water rinse. The fact that the protective film is so readily soluble in water, makes the protection afforded a temporary one, of course, but in the field of interim protection . . . between operations, or during shipment from one department to another . . . this simple treatment is both satisfactory and economical.

★ ★ ★

**Recently** a maker of steel washers, having used Magnus 26N for some time for interim rust protection, tried it in one of their deburring barrels, with the idea that the material would provide adequate assistance in deburring, and at the same time, supply good rust preventative effect to the deburred work.

★ ★ ★

**The** results of this test were so satisfactory that today their entire output is barrel deburred with 26N solution. Washers from the machining operation are charged into the barrels, together with a 26N solution containing about 8 ounces to each 10 gallons of water. Washers are thoroughly deburred, while all traces of machining oil are removed. It takes about ten minutes per charge, after which the washers are removed and left to dry just as they are. Washers dry without stickiness and are packed and shipped in a completely clean, non-rusty condition.

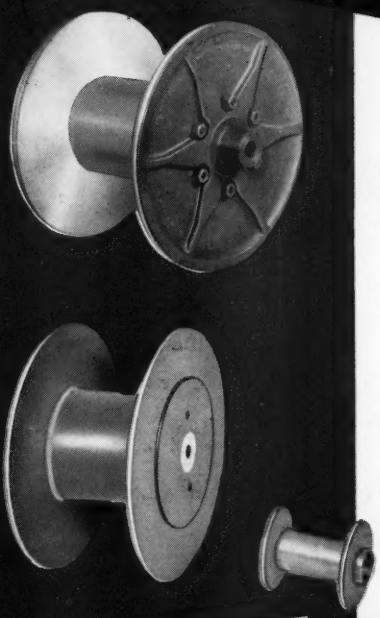
★ ★ ★

**This** combined deburring and rust-preventing treatment can be applied to many other small steel parts.


a name that has stood for sturdy, dependable yarn beams in the Textile Industry for over 20 years . . .

MILTON MACHINE offers you A RELIABLE SOURCE OF

RUGGED STEEL HEAVY DUTY PROCESSING REELS



**HEAVY DUTY REEL**

Shown at left is one of several wire rope or cable reels designed and manufactured over the past several years to meet the heavy duty service of a wire rope manufacturer. Flanges with rope brake rim grooves are heavily ribbed semi-steel castings.

**WELDED STEEL REEL**

At left is one of several welded reels made to wire rope manufacturers' specifications for replacement of light weight pressed steel reels which failed to hold up under heavy duty service.

**SOLID STEEL PROCESSING SPOOLS & BOBBINS**

Another of our products for the unusual service applications of the wire industry.

**INQUIRIES INVITED . . .** Send us a sketch or print stating the limiting dimensions and services required—or write or phone. Our field engineer-representative will be glad to describe our facilities for supplying you with special heavy duty processing reels, spools or bobbins.

*let's get acquainted..*

SEND FOR BULLETIN 52-W

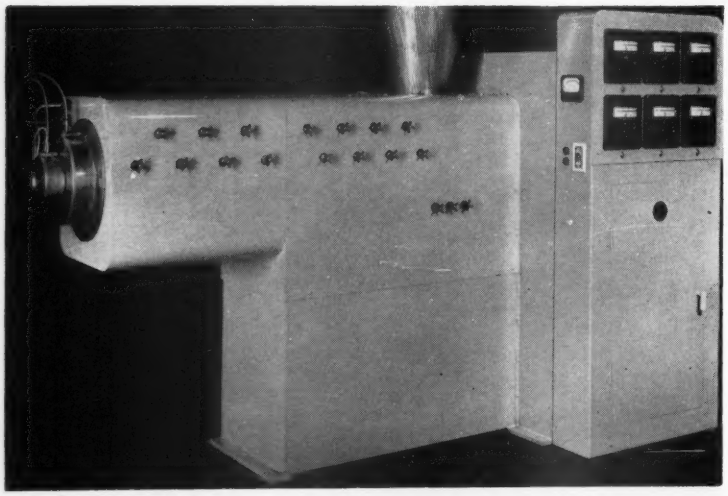
MILTON MACHINE WORKS, Inc.

DESIGNERS — ENGINEERS — MANUFACTURERS

MILTON • PENNA.

# "Modern" EXTRUDING EQUIPMENT

is designed for those electric wire manufacturers who demand the best in extruders



MPM Model No. 450 Silent Chain Drive Extruder

MPM Extruders are used by nearly all material suppliers, by laboratories for quality testing, and for production. One large electric wire manufacturer now has 17 MPM extruders—reorders for them indicate the satisfaction they give.

*MPM Extruders have the utmost flexibility and will handle a wide range of compounds and cross sections and are equipped with the best in temperature controls.*

When sending inquiries, please include all available details of your requirements as to production, materials to be extruded and electric current characteristics. We can then suggest the equipment best suited to your purpose. Made for round or flat wire and for tubing.

**MODERN PLASTIC MACHINERY CORP.**
15 UNION STREET
LODI, NEW JERSEY, U.S.A.


## Library Reference Service at National Metals Exposition

**The** Special Libraries Association will exhibit new books and periodicals in Booth 1020, Center Building, at the National Metals Exposition, Philadelphia, October 20th - 24th, 1952.

★ ★ ★

**The** metallurgical and engineering librarians on duty in the booth will maintain a library reference service for visiting metallurgists and engineers. Bibliographies, lists of books, and information on library services will be available for distribution.

★ ★ ★

## New Catalog of Precision Metalworking Machines

**A completely** new 32 page catalog describing how Di-Acro Metalworking Machines perform a wide variety of forming, cutting and punching operations in medium and light weight materials is available upon request from **O'Neil-Irwin Mfg. Co.**, 635 Eighth Avenue, Lake City, Minnesota.

★ ★ ★

**Printed** in two colors, a feature of the catalog is the arrangement of machine specifications and material forming capacities into tabular form for quick, ready reference by the reader.

★ ★ ★

**Additional** features include photographic case histories of how numerous companies are applying "Dieless Duplicating" techniques to their particular problems, photos and descriptions of new and improved products, a listing of accessories, and complete information on both the Di-Acro Engineering Service Offer and the Di-Acro Warranty Agreement.

★ ★ ★

**Seven** basic machines—benders, brakes, notchers, punch presses, rod parters, rollers, and shears—are available in 36 sizes. Twenty-six of these machines are hand operated; the ten power models are for use where long production runs and operator fatigue are considerations.

★ ★ ★

**Advantages** of the machines are long wear, precision reproduction and versatility—each machine can be tooled for any number of operations.

# Outstanding Personalities of the Wire Industry

### Appointed Carboloy Finance Manager

**R. R. Roberts** has been named Manager-Finance by **K. R. Beardslee**, General Manager of the **Carboloy Department, General Electric Company,** Detroit 32, manufacturers of specialized metals and cemented carbide tools for the metalworking industry.

★ ★ ★

**Mr. Roberts** was previously Manager of Marketing Administration for the X-Ray Department of General Electric Company in Milwaukee. A native of Wise, Va., he started with G-E in 1936 in the Business Training Course at Bridgeport, Conn. From 1941-1947 he was traveling auditor and served as financial assistant to the vice president in the Affiliated Manufacturing Companies Department of G-E before joining the X-Ray Department in January, 1948.

★ ★ ★

**In** his new position with the Carboloy Department, Roberts replaces S. B. Strom who has been appointed Manager-Finance for the Components Products Division of G-E in Fort Wayne, Indiana.

★ ★ ★

### Appointed General Superintendent of Macwhyte Company

**As** of August 1, 1952, **Archie M. Naysmith** was appointed General Superintendent and Plant Engineer. He was formerly Plant Engineer.

★ ★ ★

**Mr. Naysmith** has an excellent background of 36 years experience, and this appointment comes in recognition of his outstanding service of more than 24 years with Macwhyte Company.

★ ★ ★

**He** came to **Macwhyte Company** 24 years ago from Scotland, where he had 12 years of experience in production, laboratory, machine shop, and plant engineering at Bruntons Ltd., Musselburgh, Scotland, manufacturers of wire and wire rope.

★ ★ ★

**During** his 36 years experience he has become familiar with the operation of all plant equipment and production processes in the manufacture of wire, wire rope, and slings.

★ ★ ★

**Mr. Naysmith** says, "My experience has taught me that a large part of any production problem is that of human relations. If you make an honest effort to understand the problem and attitude of others, they are more likely to work in amity with you."

★ ★ ★

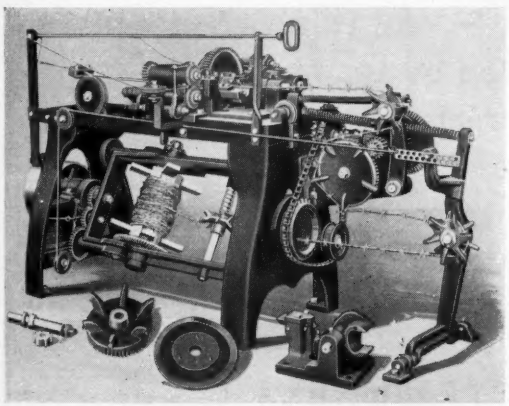
**R. B. Whyte, Jr.** has been appointed Assistant General Superintendent and Assistant Plant Engineer. For the past several years R. B. Whyte, Jr. has been closely associated with Mr. Naysmith as his assistant.

★ ★ ★

### Sherman L. Kelly

**Sherman L. Kelly**, 83, inventor and one of the founders of the **Electric Auto-Lite Co.**, Toledo, O., died on Aug. 21.


# GLADER BARBED WIRE MACHINES



USED THROUGHOUT THE WORLD . . . for producing barb wire of any style or type of 2-point or 4-point wire, made from round wire.

GLADER COMBINATION BARB WIRE MACHINE . . . makes 2-point and 4-point barb wire.

GLADER BARB WIRE MACHINES also makes 2-strand plain cable wire, without barbs.

★ ★ ★ ★ ★

Also manufacturers of the world-renowned GLADER WIRE NAIL MACHINES, producing wire nails from ¼" brads to 12" spikes.

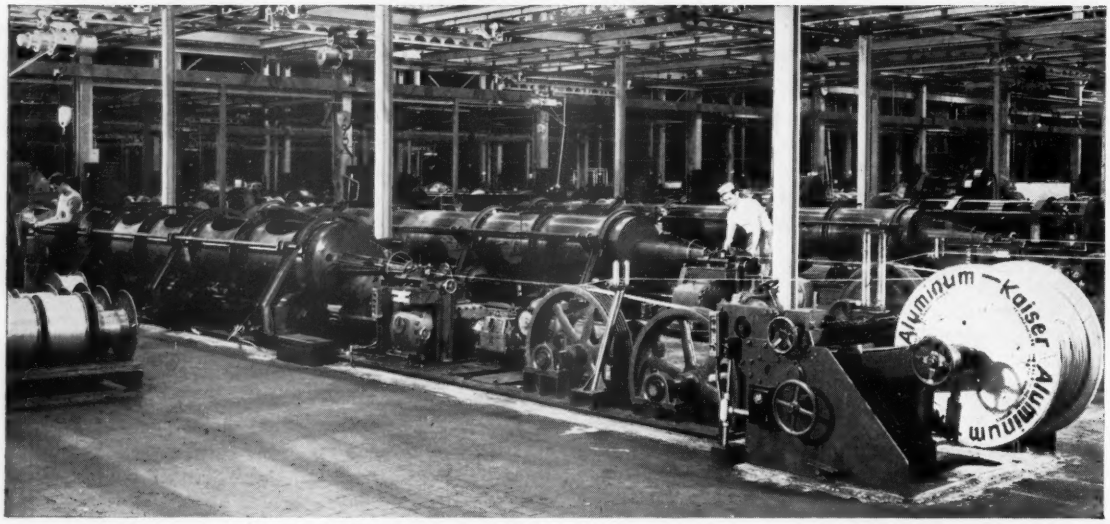
*Write for Bulletin No. 32*

## EXPORT DEPARTMENT, WM. GLADER MACHINE WORKS

122 EAST 42nd STREET, NEW YORK 17, N.Y., U.S.A. CABLE ADD: "SEBOLDEX—NEW YORK"

## NEW 22" SPOOL 750 RPM TUBULAR STRANDER

HYDRAULIC LIFT REEL STAND — INFINITELY VARIABLE TRAVERSE AIR CONTROLLED
DOUBLE DRUM HAUL-OFF WITH LINK BELT P.I.V. — AIR OPERATED BRAKING SYSTEM



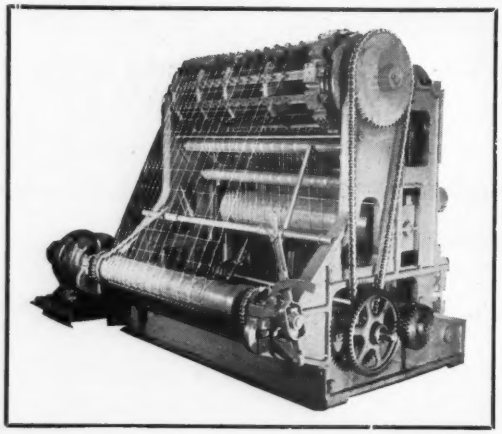

HMT
ESTABLISHED 1846 HUGHESVILLE MACHINE & TOOL COMPANY
WIRE & PROCESS MACHINERY

*Hi-Efficiency*

Exclusive Representation in Canada by
THE LARSON COMPANY
Toronto, Ontario

HUGHESVILLE MACHINE & TOOL CO.
54 ACADEMY STREET
HUGHESVILLE, PA.
'Phone: 129-A

## INTERLOCKING FENCE LOOMS



- Fastest—Most Efficient.
- Preferred by Leading Mills.
- Low Maintenance Cost.
- Wrapped Stay Fence.
- Straight Stay Wires.
- Integrated—Space Saving.
- Replaceable Main Bearings.
- Single or Double Strands.
- Years of Low Cost Production.

Write for Detailed Information — Without Obligation

**Interlocking Fence Co., Dept. L, Morton, Ill.**

*Specialists In Fence Looms*

### AIEE Names Hickernell Tech. Operations Committee Head

**L. F. Hickernell,** chief engineer of the **Anaconda Wire & Cable Co.,** Hastings-on-Hudson, New York, has been named Chairman of the newly formed Committee on Technical Operations of the **American Institute of Electrical Engineers.**

★ ★ ★

**The** new committee will be coordinating agency for the AIEE's five technical divisions, which represent 38 technical committees; and will supervise all technical affairs of the Institute.

★ ★ ★

**Formerly,** Mr. Hickernell has been chairman of the Institute's Technical Advisory Committee. The new committee is a merger of the Advisory Committee and the Technical Program Committee, with the addition of the Chairmen of the Committees on Standards, Education, Research, Publication, Management, Safety, and the committee on Awards of Institute Prizes.

★ ★ ★

### Joins INCO Research Laboratory

**The** appointment of **Dr. C. Manning Davis** as Head of the Analytical Section of the Research Laboratory of **The International Nickel Company** at Bayonne, New Jersey, effective August 1, was announced by **N. B. Pilling,** Director of the Research Laboratory.

★ ★ ★

**Dr. Davis** was in charge of The Elgin Watch Co. Fellowship at the Mellon Institute for Industrial Research at Pittsburgh from November, 1947, until July 1, last. His activities there included pilot plant operation, organic synthesis and organic analysis. Prior to that he was in charge of the Analytical Laboratory of the Fisher Scientific Co. at Pittsburgh for over five years.

★ ★ ★

**He** has been Chairman of the Analytical Division of the Pittsburgh Section of the American Chemical Society and was Chairman of the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy in 1951.

★ ★ ★

**He** received his B. A. from Mississippi College in 1938; M. S. from Tulane University in 1940; and Ph. D. from University of Pittsburgh in 1952.

★ ★ ★

### New Sales Engineer In Los Angeles Area

**Walter S. Schamel** has been appointed district manager of the Los Angeles office for **American Wheelabrator & Equipment Corporation.** He opened new offices at 3155 Leonis Blvd., Vernon, Los Angeles 58, on August 1, and handles the company's complete line of products, including dust collectors, abrasive blasting machines, and other foundry equipment.

**Schamel** has been in the company's dust and fume control division at the home office for the past 6½ years, first as sales engineer and most recently as assistant technical director. He is a civil and mechanical engineering graduate of the Missouri School of Mines and Metallurgy.

★ ★ ★

### Advanced by National Electric Products

**J. I. Bauer** was recently promoted to Vice President and General Sales Manager of the **National Electric Products Co.,** Pittsburgh.

**WIRE SPOOLS, ALL-STEEL, LITHOGRAPHED**

Ends and traverses may be shipped separately and assembled easily in your plant on a hand, foot, or power press.

5" and 6½" diameter ends with 1-15/16" diameter traverses.
10½" diameter ends with 3½" diameter traverses.
Traverse lengths up to 12".

**J. L. CLARK MANUFACTURING CO.**
600 23rd AVENUE • ROCKFORD, ILLINOIS

### Litchfield Made Head of Alcoa Subsidiary

**Lawrence Litchfield, Jr.**, has been elected president of Alcoa Mining Company, New York City, and of Surinaamsche Bauxite Maatschappij, Paramaribo, Suriname, both subsidiaries of **Aluminum Company of America.** He succeeds **Frank B. Cuff**, who retired August 1.

★ ★ ★

**Mr. Litchfield**, who has been serving as vice president of Alcoa Mining Company and Surinaamsche Bauxite Maatschappij, is a veteran of 27 years service with the company. He is a graduate of the United States Naval Academy in Annapolis, where he received his ensign stripe in 1920. Following a year in the Navy, he took post graduate work at Harvard. He was graduated magna cum laude with a B. S. degree in mining in 1923. After a period of service with the U. S. Bureau of Mines, he joined ALCOA in 1925 as geologist and mining engineer. Mr. Litchfield is also president and director of Alcoa Exploration Company.

★ ★ ★

### Joins Okonite's Cleveland Office

**Kenneth R. Dodge** recently joined the Cleveland, Ohio, office of **Okonite Co.** as a sales engineer handling wire and cable sales to industrial plants and utilities in northern Ohio.

★ ★ ★

### Consulting Engineer Retires from International Nickel

**James A. Rabbitt**, Inco Consulting Engineer, and an authority on Japan and the Far East, retired from active service with **The International Nickel Company, Inc.**, on August 31, Dr. Paul D. Merica, President of the Company, announced recently.

★ ★ ★

**The** services of Mr. Rabbitt, who has been with Inco for more than 22 years, will continue to be available to the Company in an advisory capacity on Far Eastern affairs.

★ ★ ★

**Mr. Rabbitt**, a native of Stamford, Connecticut, was 75 on August 6. One of his first undertakings after joining International Nickel in December, 1929, was a survey of the industries of Japan. From 1932 to 1940, he was adviser and acting director of the Company's Japan Nickel Information Bureau and also editor-in-chief of the Japan Nickel Review, a quarterly metallurgical journal.

★ ★ ★

### Sales Promotion Manager Appointed by Firth Sterling

**Firth Sterling Inc.** announces the appointment of **Thomas E. Pickering** as Sales Promotion Manager. He will direct the promotional activities for all divisions of the Corporation and will be located at the general offices, 3113 Forbes St., Pittsburgh, Pa.

★ ★ ★

**For** eight years preceding the war, Mr. Pickering was engaged in the radio advertising business. After three years in the Army Air Force, he was Sales Promotion Manager of Danforth Co. for five years. Mr. Pickering recently resigned as President of Meridian Films Corp. He attended Princeton University.

★ ★ ★

### Appointed Stronghold Representative

**Stronghold Ohio Corporation**, producers of screws, nuts, bolts, etc., has announced the recent appointment of **James P. Quinn** to cover Cleveland territory.


**USERS OF THESE CABLE REEL BORERS REPORT**

***PRODUCTION INCREASES UP TO 500%***

**In one single operation, this remarkable machine bores ALL the holes in a wooden cable reel head. In addition, it has the exclusive Root Patented Hydraulic Feed which provides a stepless range of feed from 2 to 29 strokes per minute. Operator is not handicapped by limited feed rate. This increases production tremendously. Can also be used for other boring purposes. Made in three sizes. *Write for Bulletin No. 132.***

**"Can honestly say this machine alone has increased our production over 200%! Our profits increased 100%!"**
**V. Fairhurst, Mgr. New England Reel and Lumber Co.**

**ROOT**
**HYDRAULIC FEED**
**REEL BORER**

**Root Reel Borer being used by New England Reel & Lumber Co.**

**B. M. ROOT CO** **YORK, PA.**

**The Company** is an affiliate of Stronghold Screw Products, Incorporated, of Chicago.

★ ★ ★

### Continental Screw Advances Three Men

**The Continental Screw Co.**, New Bedford, Mass., recently announced the appointment of **Harvey F. Phipard Jr.** as director of research and engineering, of **Edward J. Locke Jr.** as chief engineer, and of **George E. Jenney Jr.** as master mechanic.

★ ★ ★

### Elected Officer of Cleveland Co.

**John A. Cortelli** was recently elected Vice President of **Clark Controller Co.**, Cleveland. His duties will be Vice President-Engineering and Chief Engineer, having served in the latter capacity since 1946.

★ ★ ★

### Made Works Manager of Wickwire-Spencer at Buffalo

**A. E. Giblin** was appointed works manager of Colorado Fuel & Iron Corp.'s **Wickwire-Spencer Steel Division**, Buffalo. He advanced to assistant plant manager of the Buffalo steel mills in 1949 and becomes work manager following resignation of **Carl J. Murray**.

★ ★ ★

### Edwards Company Moves Offices

**E. H. Edwards Co.**, manufacturer of wire rope, has moved its San Francisco office to its plant in South San Francisco, Calif.

★ ★ ★

### Becomes Officer of Weldwire Co.

**David Rozet** has joined **Weldwire Co.**, Philadelphia, as vice-president and director of research. Previously he was employed for more than nine years by Arco Corp., Philadelphia. Since his graduation from the University of Brussels (Belgium) with a D.Sc. degree, Dr. Rozet has been active in this country and in Europe in various phases of research on coating and arc welding electrodes.

★ ★ ★

### Made District Manager For C. F. & I.

**F. G. Lindstrom** has been appointed by the **Wickwire Spencer Steel Division** of the **Colorado Fuel and Iron Corporation** to serve as their New England District Manager, with headquarters at Palmer, Massachusetts.

### To Head Secondary Products Div.

**Robert J. Thomas** has been appointed manager of the newly created secondary products division of **Tennessee Coal & Iron Division**, United States Steel Corp., Fairfield, Ala. Mr. Thomas was formerly special sales representative in the sheet and wire division.

★ ★ ★

### Made Department Manager by National Electric Products

**C. Wesley Merritt** has been named sales manager of the newly organized railroad department of **National Electric Products Corp.**, Pittsburgh, Pa. Mr. Merritt has been with National Electric since 1940.

★ ★ ★

### Bridgeport Brass Sales Changes

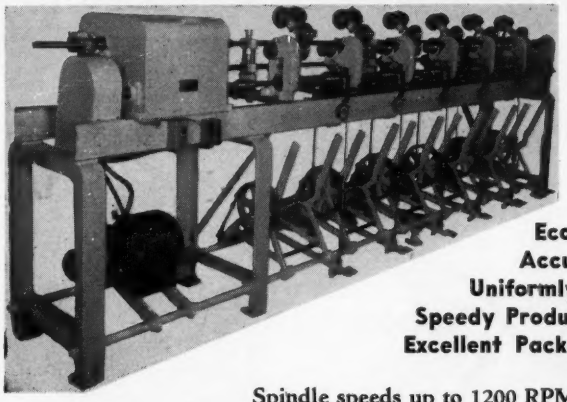
**Chester M. Adams**, general sales manager of **Bridgeport Brass Company**, announces the following changes in personnel:

★ ★ ★

**George H. Baldwin**, who was formerly sales manager of mill products, has been promoted to the position of assistant general sales manager, and will now be concerned in the broad problems of the company's over-all sales operations.

★ ★ ★


**DEPENDABLE • ACCURATE WINDING**



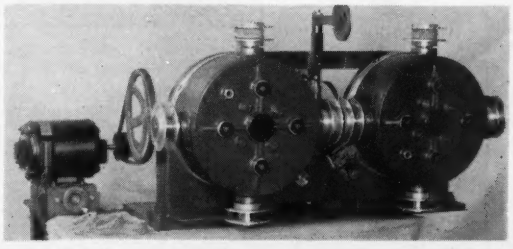
**BOYD MULTI-HEAD SPOOLER**

***Improved Design***
***Precision Engineered***

**Economy Operation**
**Accurate Winding**
**Uniformly Smooth**
**Speedy Production**
**Excellent Package Appearance**

Spindle speeds up to 1200 RPM are possible. Can be had with any number of spindles from one to twelve. The six-head spooler shown above has a common traverse for all spindles. Each spindle is started independently by manual control — and stops automatically at predetermined footage. Traverse changes easily made. Winds wire on spools up to ½" to 8" — wider spools can be provided for. Anti-friction bearings throughout. Counter stop-motion, wire compensators and wire straighteners optional. Operator requires no training, skill or experience.

**BOYD CONTINUOUS COIL WINDER #3130**
**Semi-Automatic**



Winds short coils (25′ to 200′) continuously. Traverse wire with layer wind. When proper length is wound, guide is forced by solenoid action to opposing spindle turning at same speed. When sufficient turns are wound on second spindle — a knife jumps between heads and cuts wire connecting the two coils. The head with the full coil indexes upward and an empty coil comes into winding position. Operator then easily removes full coil and ties it as desired. Works particularly well with bell and stove pipe wire. Can be speeded for long coils — slowed for shorter. ½ H.P. motor provides ample power. Operator requires no training, skill or experience.

**BOYD & SONS MANUFACTURING CORP.** 1434-38 Callowhill St., Philadelphia 30, Pa.

**Richard L. Allen** has been appointed as sales manager of mill products. In making these announcements, Mr. Adams said the company feels certain that the many years of experience which both Mr. Baldwin and Mr. Allen bring to their new appointments will benefit its customers in improved service on all products.

★ ★ ★

### Elected Chairman of Standard-Toch

**M. H. Corbin,** President, recently announced the election of **William Burchard Day** Chairman of the Board of **Standard-Toch Chemicals, Inc.,** formerly Standard Varnish Works. A native of Kankakee, Ill., he has been associated with the firm since 1908 and has served in many capacities advancing to his present position upon the retirement of J. Heath Wood. Mr. Wood, who came to Standard Varnish Works in 1919, was elected its President in 1930 and finally became Chairman of the Board in 1949.

★ ★ ★

### Reynolds Metals Promotions

**Three** promotions to key positions in the manufacturing organization of **Reynolds Metals Company** and a wholly-owned subsidiary, **Reynolds Alloys Company,** were announced recently by **J. Louis Reynolds,** Vice President in charge of Operations.

★ ★ ★

**George L. Simms,** formerly manager of the McCook Sheet Mill in Illinois, has been made General Manager of both the McCook Plant and Reynolds Alloys Company at Listerhill, Alabama.

★ ★ ★

**Donald Hipp,** formerly Manufacturing Vice President of Reynolds Alloys, has been promoted to Vice President and Manager of Reynolds Alloys facilities succeeding the late M. A. J. Phillips who died suddenly on July 22.

★ ★ ★

**John E. Larson,** formerly Plant Superintendent at McCook, has been elevated to Manager of the McCook facilities, replacing Mr. Simms.

★ ★ ★

### Paper Company Executive Resigns

**The** resignation of **J. H. Friend,** Vice President of **International Paper Company** and General Manager of its Southern Kraft Division, has been announced by **John H. Hinman,** President. Mr. Friend will continue to serve as a member of the Board of Directors and will be available in a consultant capacity on special projects.

★ ★ ★

**Succeeding** Mr. Friend as General Manager of the Southern Kraft Division will be **Erling Riis,** Vice President and Assistant General Manager, Mr. Hinman said.

★ ★ ★

### Pittsburgh Steel Changes

**Pittsburgh Steel Co.,** Pittsburgh, has elected **Allison R. Maxwell, Jr.** vice president, sales and **Marvin J. Bair** general manager of sales. **Norman J. Froelich,** assistant general manager of sales, is now also in charge of the sale of rods, manufacturers wire, merchant products and chain link fence.

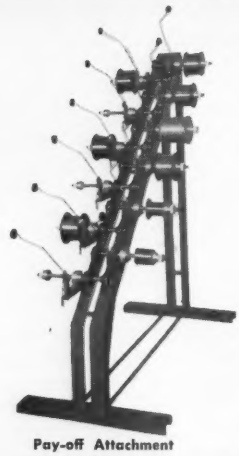
---

**CHANGED YOUR ADDRESS** OR JOB? Please advise us promptly giving the old address and your title as well as the new. This will help us to keep WIRE AND WIRE PRODUCTS coming to you without interruption.

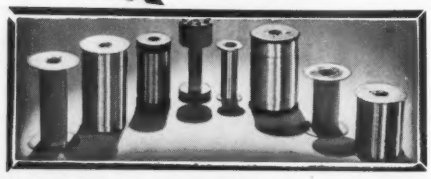

**STANDARD UNI-DRIVE WIRE WINDER.**

INCREASE YOUR PRODUCTION WITH THIS WINDER

Wire Winder



Pay-off Attachment



Various types of supply packages that may be wound on Standard Uni-Drive Wire Winder.

**PAYOFF**

Our payoff attachment is made with self - aligning ball bearings and a compensating attachment to control the tension of each end. Applies same tension when spool is empty as when full.

The new Uni-Drive Winder with Payoff Attachment is new in design and incorporates several improved and tested features.
Production is stepped up through increased speed. It produces smooth, even and accurately wound spools of wire in single or multiple ends. All strands parallel—no over or under-winding. Automatic Stop-Motion controls each strand. Compensating attachment produces perfectly controlled tension. Traverse adjustable from 1⅜" to 5½" between spool heads without changing cam.
Designed especially for winding wire to be braided and shielded for electrical conductors up to ¾" diameter.
Payoff can be equipped with Carboloy Guide Inserts at additional cost.

**STANDARD MILL SUPPLY**
PAWTUCKET, R.I., 1064-1080 Main St.
NEW YORK, N.Y., 6708 Empire State Bldg.
CHARLOTTE, N. C., 2319 Hutchison Ave.

### Hugh J. Fraser

**Hugh J. Fraser,** Vice President in General Charge of All Plant Operations in the United States of **The International Nickel Company, Inc.,** died on Friday, August 22 after a brief illness, in his 55th year. He resided at 45 Woodbine Avenue, Larchmont, New York.

★ ★ ★

**Mr. Fraser** joined the Huntington (West Virginia) Works of The International Nickel Company, Inc., in May, 1923, serving in various technical and operating capacities before being promoted to the Company's New York Office in February, 1935, as Assistant Manager of the Production Department. He was elected Vice President in March, 1947, and in the following June was made Vice President in General Charge of All Plant Operations in the United States of International Nickel. He was also Assistant Vice President of the parent organization, The International Nickel Company of Canada, Limited, since June, 1943.

★ ★ ★

### Chester H. Fisher

**Chester H. Fisher,** 50, secretary and treasurer of **Cowles Chemical Company,** Cleveland, Ohio, died suddenly July 24 of a heart attack at his home in Brecksville, Ohio. Mr. Fisher came with Cowles in 1929, was elected treasurer in 1943 and secretary in 1952. His steady influence and great knowledge of financial and accounting matters was of inestimable value to Cowles through the years and he gained the respect and admiration of everyone who worked with him.

★ ★ ★

### James C. Shepherd

**James C. Shepherd,** 57, executive vice president of the **Sheffield Steel Corp.** since 1941, died on Aug. 25th at Kansas City, Mo.

★ ★ ★

### Joseph H. Hunter

**Funeral services** were held in Los Angeles on August 27th for Joseph H. Hunter, 84, former Detroit industrialist, who died after a long illness. He had been living in California for the past two years.

★ ★ ★

**Mr. Hunter** formerly was president of the Detroit Insulated Wire Company, which was later merged with the General Cable Company of New York.

★ ★ ★

### Harry N. Law

**Harry N. Law,** 70, secretary of the **Bristol Brass Corporation** died on August 6th at his home in Forestville. He had been in ill health several years.

★ ★ ★

**Mr. Law** was born in Albany, N. Y., April 10, 1882, a son of George and Sarah McCall Law. He was educated in Albany schools and was graduated from the Albany Commercial College. He came to Bristol in 1890.

★ ★ ★

### Henry G. Sommer

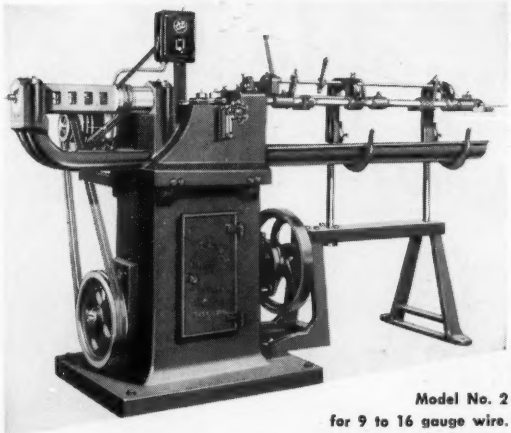
**Henry G. Sommer,** 53, chairman of the board of the **Keystone Steel & Wire Company,** Peoria, Ill., died early in September at his home in Peoria. He was working in his garden when he suffered a fatal heart attack.

★ ★ ★

(*Please turn to page* 1107)


# STRAIGHTEN and CUT SMALL WIRES

## *ON FAST, DEPENDABLE WELLS' AUTOMATIC ROTARY MACHINES*



Model No. 2 for 9 to 16 gauge wire.

**THIS MACHINE WILL CUT wire accurately and fast in any length from 7½" up to 25', but must be ordered for the maximum lengths to be cut.**

**The straightener flier runs in ball bearings. Has 2 H. P. motor arranged for direct drive. Drive gears are located inside of the base. Illustration shows the flier and drive open to show mechanism.**

**Furnished with 2 sets of hardened tool steel dies.**

***WELLS' machines are backed by 58 years of experience and of constant effort to improve their efficiency.***

***The result for you is a line of straightening and cutting machines that will handle the toughest jobs, day in, day out, year in, year out, with little or no servicing. Customers report uniformly high satisfaction with the operation of their WELLS equipment.***

**Built in a complete range of sizes for all wire gauges.**

send for Catalog No. 50 covering the full line.

*Frank L. Wells Company*

**KENOSHA • 5821 Fifth Avenue • WISCONSIN**

***Builders of Fine Wire Working Machinery***

# A Review of Recent Wire Patents

2,605,725, MACHINE AND METHOD FOR COLLAPSING SPRINGS IN POCKETS, Patented August 5, 1952, by Robert H. Stevens, Detroit, Mich., Assignor to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware.

The machine includes a device for moving a cloth pocket and spring in a direction transversely of the axis of the spring, means for gradually drawing the spring towards its collapsed position, a magnetic device for collapsing the spring and retaining it in its collapsed position after which the open edges of the pocket are secured together.

★ ★ ★

2,605,738, APPARATUS FOR DRYING AND/OR IMPREGNATING ELECTRIC CABLES, Patented August 5, 1952, by George Thomas Wilson Grieve, Shooters Hill, London, England, Assignor to British Insulated Callender's Cables Limited, London, England, a British company.

About the winding drum is a fluid-tight casing to enclose the cable body but having at least one opening for the passage of fluid.

★ ★ ★

2,605,906, HANGER, Patented August 5, 1952, by Joseph F. Pontius, Alhambra, Calif.

A hanger for windows is provided, constructed of a single length of wire and forming hooks of varying sizes.

★ ★ ★

2,605,907, RACK FOR TOAST AND THE LIKE, Patented August 5, 1952, by Arthur Hirst, Lancing, England.

The rack is composed of wire, part of which is formed in a normally contracted spring helix, and the remainder formed into holders for attachment to the rim of a plate or the like.

★ ★ ★

2,605,947, MACHINE AND METHOD FOR MAGNETICALLY TURNING SPRINGS IN POCKETS, Patented August 5, 1952, by Robert H. Stevens, Detroit, Mich., Assignor to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware.

Springs in fabric pockets are turned by this machine which includes a supporting structure, a device on the supporting structure for advancing the pockets and springs through the machine and a number of sets of magnets for producing magnetic fields disposed at an angle to the axis of the springs as the springs are advanced therethrough for turning the springs in the pockets.

★ ★ ★

No. 2,606,134, PROCESS OF MAKING INSULATED ELECTRICAL CONDUCTORS, patented August 5, 1952, by Philip F. Sanders, Lima, Pa., assignor to E. I. duPont de Nemours & Company, Wilmington, Del., a corporation of Delaware.

In this process the wire conductor is wrapped with a polymeric tape comprising polytetrafluoroethylene or copolymers containing tetrafluoroethylene in substantial amounts, then wrapped firmly with glass yarn, and thereafter heated to at least the fusion temperature of the polymeric material, the polymeric tape being thereby fused into a continuous covering, with the covering bonded to the conductor, under the influence of heat and the pressure resulting from the thermal expansion of the polymeric material.

★ ★ ★

No. 2,606,600, CUSHION RETAINING DEVICE FOR CHAIR BACKS, patented August 12, 1952, by Philip Challis, London, England.

This device is formed of wire strands bent to form a structure to hold the cushion and to be attached to the back of a chair.

★ ★ ★

No. 2,606,650, CONTINUOUS WIRE DRAWING MACHINE, patented August 12, 1952, by Martin E. Evans, Brooklyn, N. Y.

In the use of this attenuation machine, it is said that plural traction means becomes unnecessary for attenuation of a number of wire strands (in a bundle) by the discs.

★ ★ ★

No. 2,606,723, MACHINE FOR WINDING ARMATURES, patented August 12, 1952, by Peter J. Burdulis, Delhi, Calif.

A wire guide unit is provided to feed wire to the armature and a special post and arm are provided to mount the guide unit.

★ ★ ★

**Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 453 Main Street, Stamford, Connecticut.**


CREPED

Thermoplastic Cable Sheathing Kraft

Now available for belting in

MULTICONDUCTOR CABLES

For softness and flexibility.
Will not wick water
into an assembly.

Merrimac Paper Co., Inc.

Mills — Lawrence, Mass.
295 Madison Ave., New York City

Tailor-made Specification Papers.

No. 2,607,096, CLOTHESPIN, patented August 19, 1952, by Gabriel F. Sousa, Portland, Oregon.

This clothespin is formed of a single piece of wire.

★ ★ ★

No. 2,607,109, METHOD FOR PRODUCING ALUMINUM-ARMORED CABLES, patented August 19, 1952, by William G. Reynolds, Louisville, Ky., assignor to Reynolds Metals Company, a corporation of Delaware.

This method is for continuously applying a non-corrosive coating of aluminum to wire cables.

★ ★ ★

No. 2,607,541, WIRE COILING MACHINE, patented August 19, 1952, by Weld Morgan and Clarke D. Wesson, Worcester, Mass., assignors to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts.

A wire take-up frame is provided including the use of two series of rotatable single-flanged wire-coiling blocks on opposite sides of their support structure.

★ ★ ★

No. 2,607,554, SUPPORT, patented August 19, 1952, by James S. Charipar, Chicago, Ill.

This device, formed wholly of bent wire, is adapted to support the upper portion of a coffee maker when the latter is not in use.

★ ★ ★

Reissue No. 23,540, METHOD OF PRODUCING A CORROSION RESISTANT COATING ON STEEL, reissued August 26, 1952, by Glenn H. McIntyre, Cleveland Heights, and Millard G. Ammon, Cleveland, Ohio.

The coating is said to be characterized by its extreme thinness, high resistance to corrosion and tenacious adherence to the steel article.

## New Folder on Acid and Alkali-Proof Equipment

**Maurice A. Knight Co.,** Kelly Ave., Akron 9, Ohio, has issued a new folder on "Permanite" equipment, a furfuryl alcohol resin manufactured by them and formed into various fiberglas reinforced products.

★ ★ ★

**The** uses of this substance and its properties are set forth and illustrated. Besides its ability to be formed into tanks, pipes and other products, it can be used as a cement for tile and bricks for floors, tank linings, etc.

★ ★ ★

**Copies** of the folder will be sent upon request.

## New Catalog on Advanced Extruding Machines for Thermoplastics and Rubber

**The Standard Machinery Company,** Mystic, Connecticut, has just published a new 12-page illustrated catalog featuring its latest models of extruding and vulcanizing equipment for the rubber and plastics extrusion industries.

★ ★ ★

**In** addition to up-to-date plastics and rubber extruders, and advanced auxiliary equipment for these units, the catalog features and describes in detail complete installations of assemblies for thermoplastic wire insulating and for continuous vulcanizing.

★ ★ ★

**A section** of the catalog is devoted to illustrated description of the Davis-Standard "Therma-Fin" heating jackets (patent pending) which are an improved feature of all the company's new extruding machines and are a great advancement in precise temperature control.

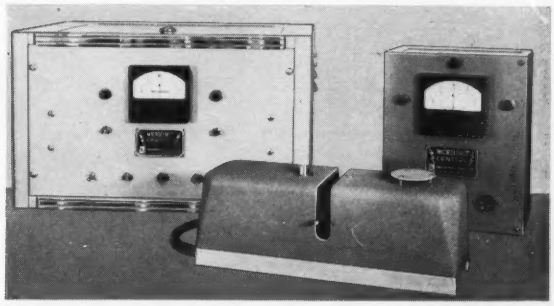
★ ★ ★

**Other** sections feature the new Davis-Standard take-up assembly for wire insulating, as well as a new wire-insulating pay-off which is automatically self-braking.

★ ★ ★

**Copies** of this new and informative catalog may be obtained by writing The Standard Machinery Company, Mystic, Connecticut.


Save Time and Material
WITH THESE
CONTINUOUS "IN-PROCESS"
QUALITY CONTROLS . . .



for WIRE INSULATORS.

The optical non-contact
MICROLIMIT AUTOMATIC
DIAMETER CONTROL WILL:

- Improve quality—by holding variation in finished wire diameter to a fraction of normal tolerance by continuous correction. Users report savings of $1000 per month per extruder on Nylon.
- Increase output—by increasing speeds without increasing scrap.
- Reduce scrap—by coming up to normal speed in one continuous operation and by immediate correction for operating variations. One user reports a 50% reduction in scrap.
- Increase operator productivity and reduce training period.
- These savings pay for equipment in first weeks of operation.

FOR STEEL ROLLING MILLS

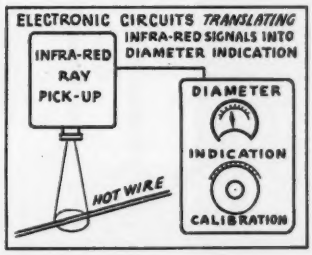
NEW NON-CONTACT INFRA-RED DIAMETER GAUGE

and automatic control for hot steel wire.

The pick-up "eye" of our new electronic gauge "looks" at hot wire or rod from a distance of several feet.

An infra-red picture of the hot rod enters the gauging head where it is translated into instantaneous and continuous indication of diameter.

This signal can also be used to control the mill as other gauges of our manufacture have been doing for years.


ELECTRONIC CIRCUITS TRANSLATING INFRA-RED SIGNALS INTO DIAMETER INDICATION
INFRA-RED RAY PICK-UP
DIAMETER INDICATION CALIBRATION
HOT WIRE

SEE THESE INSTRUMENTS AT THE CONVENTION . . . . LOOK US UP . . . . OR WRITE FOR FULL DETAILS

IGC INDUSTRIAL GAUGES CORPORATION, ENGLEWOOD, N. J.

## New Metron Technical Data Sheet

**This** describes the Series 57M Heavy Duty Tachometer Heads for measuring low speeds, either rotational or linear. The combination of built in gearing, ruggedness, and adequate enclosure against dirt, abrasives, and splashing liquids insures the ideal answer to the problem of measuring low speeds directly and under adverse conditions.

★ ★ ★

**It** is available to our readers by writing direct to the **Metron Instrument Co.**, 432 Lincoln St., Denver 9, Colo.

## Probat Spring Testing Machines

**Springs** are important and indispensable elements of construction in the manufacturing industry. Experience has shown that improper spring action or breakage of only one seemingly unimportant spring can cause serious failures. It is therefore wise to meet those troubles in advance.

★ ★ ★

**Due** to the many possible variations of material and heat treatment, it is simpler and safer to check the finished product to guarantee that the spring will perform properly its function in the mechanism.

★ ★ ★

**Probat** Testing Machines are made for the extremely accurate testing of all types and sizes of springs, and are capable of accurately testing most types of springs ranging from 1 lb. up to 55 tons and more. To accommodate this range of sizes, there are 10 standard models of the Probat Spring Tester with suitable scales available for each. For special applications, the manufacturer can make special attachments to suit a customer's requirements, including specially built machines and automatically operated testers, with magazine feeds that will test and sort the springs.

★ ★ ★

**These** testing machines are so designed that they will appeal to various departments of any plant:

**(1) The laboratory technician will find a precision machine that is extremely sensitive and accurate for the most exacting work.**

**(2) The inspection department will find it an accurate and easy to use tool for quality control, sampling and for 100% inspections.**

**(3) The production department will appreciate its ruggedness and ability to give exact readings for high production, day in and day out.**

★ ★ ★

**Full** information on these testers may be procured from Emmericher Maschinenfabrik von Gimborn & Co. K. G., Emmerich, Germany.

## Joins National Electric Products

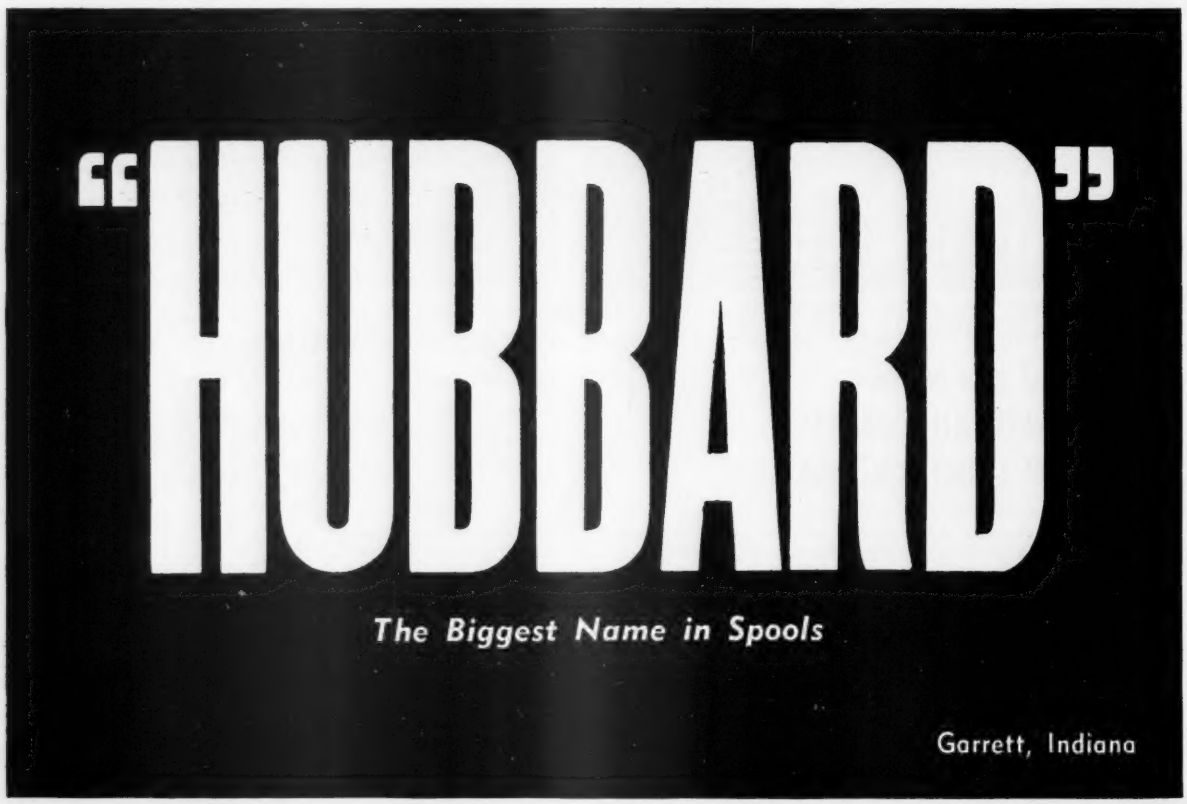
**Robert Johnson**, appointed product engineer, **National Electric Products Corp.**, Pittsburgh.

## Norton Elects New Officer

**Wallace L. Howe** has been elected a vice-president and director of the Norton Co., Worcester, Mass., succeeding **Milton F. Beecher,** who is retiring.

## Electric Cable Repair Kit Introduced by Gas Arc Supply

**Gas Arc Supply** has introduced a new "Fast Fix" kit for on-the-job repair of electric welding or power cable. This kit contains all necessary tools and replacement parts for (1) putting new lugs on #14 through #6 power cable, and (2) splicing or putting new lugs on #6 through #4/0 welding or ground cable. Rubber sleeves and friction



tape are provided for insulating and properly finishing off the work. By making possible immediate repair of cable on the job, the "Fast Fix" more than pays for itself by eliminating the expense and delay of returning cables to a dealer for repair or splicing.

★ ★ ★

**Of** special interest is the "Tweco" lug set block and punch provided for installing solder type lugs and splicers mechanically. There is no heat or solder, no scorched rubber or burnt strands, no stiff joints or acid residue corrosion, and installation is completed in 1/4 the time. High conductivity is assured by the impacted copper-to-copper contact between lug and splicer barrels and the cable strands.

★ ★ ★

**For** a catalog sheet or further information, write Gas Arc Supply, 223 North 16th Street, Philadelphia 2, Penna.

### Wire and Cable Catalog Issued by U. S. Rubber

**The** electrical wire and cable department, **United States Rubber Company**, has published a new, 186-page general catalog of its line of more than 500 different types of wires and cables.

★ ★ ★

**The** catalog contains comprehensive data on construction and operating characteristics for such products as control and signal cables, railroad wire and cables, wire and cables for the building industry, telephone wire and cables, mine cables, and portable cords. A detailed technical engineering data section is also included.

★ ★ ★

**Copies** of the catalog may be obtained from R. H. Turner, United States Rubber Company, Rockefeller Center, N. Y.

### New Brochure on Wet Blasting

**A new** brochure, "Wet Blasting in Precision Finishing," has just been published by **American Wheelabrator & Equipment Corporation**, 1184 South Byrkit Street, Mishawaka, Indiana. This six page brochure shows the application of wet blasting to such work as die and mold finishing, die and mold maintenance, tool finishing and deburring, heat treat scale removal, and surface preparation for plating in all applications where close tolerances on work must be maintained.

★ ★ ★

**The** brochure is fully illustrated, showing parts both before and after wet blasting and also showing some typical installation photographs of parts being cleaned. Among the industries represented by actual examples are glass molding, plastic molding, rubber molding, extruding, heat treating, and tool plating.

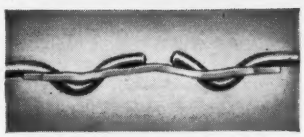
★ ★ ★

**To** receive a copy of this brochure, write to American Wheelabrator & Equipment Corporation for bulletin No. 43.

### Folder on Aluminum

**Reynolds Metals Corporation**, Louisville 1, Ky., has issued a 12-page brochure entitled "Reynolds Aluminum—the Modern Approach to Product Design and Fabrication."


# WIRE PATENTING MADE EASY... WITH LATEST MANCO SPLICER



Manco clips afford a positive lock of the wire ends. Photo above shows clip straightened and wire deformed by splicing operation. Clips are cut off after patenting operation.

Heat number of coil can be stamped on clip providing positive quality control.

The new Manco Clip Splicing Method is the fast, efficient, and low cost way to connect the wire ends of coils for drawing through patenting furnaces. Operator merely slips wire ends into splicing clip alternately and locks the clip using the hydraulic Guillotine Splicing Unit. Manco Clips are positive in action and will not loosen under the 1500°-1800° temperatures and tension of the patenting operation.

The Manco Splicer eliminates heating, manual bending, and the difficulty of tied ends. Welding equipment where used can be eliminated, and with it the problem of weld crystallization in patenting.

**WRITE TODAY FOR COMPLETE INFORMATION**

**See demonstration in Booth No. 491**

**Iron and Steel Exposition • Cleveland, Sept. 30-Oct. 4**

## MANCO MFG. COMPANY

**DEPT. W10, BRADLEY, ILLINOIS**

**In** this the advantages of aluminum are outlined and such topics as fabrication, finishes, wire, rod, bar, tubing, pips, shapes and the properties of aluminum alloys are treated under separate appropriate headings. Copies are available upon request.

## New Company Making Wire Machinery

**Insulated** wire and cable manufacturers will be interested to learn of the recent incorporation of **Wire Insulating Machinery, Inc.,** 260 Tolland Turnpike, Station A, Manchester, Conn.

★ ★ ★

**The** company is headed by **H. H. Duff,** who has had 20 years experience in designing and building wire mill machinery, besides extensive experience in the manufacture of insulated wire.

★ ★ ★

**The** concern is in production on a line of new equipment of advanced design, based on a first-hand knowledge of the needs of the mills. The line presently includes continuous take ups, pay off stands, curing troughs, capstans and a continuous take up and capstan in one package unit.

★ ★ ★

**Future** announcements in WIRE AND WIRE PRODUCTS will give details of the new machines, one of which will be a completely new electronically controlled traverse.

## New Carboloy Bulletin on Drawing Dies

**In** this bulletin, the **Carboloy Department of General Electric Company,** 11115 E. 8 Mile Avenue, Detroit 8, Michigan, asks the question "In any wire drawing operation, why not get the bonus tonnage from your wire dies" and then proceeds to show why Carboloy wire dies will do this. A copy of this bulletin "Bonus Tonnage" will be mailed to those who request it.

## Making Coloring Pigments for Lacquers and Synthetics

**Extruders** of plastic covered wire will be interested in the advantages that are available by coloring with R-B-H "masterbatched" pigments, made by R-B-H Dispersions Div. of the **Interchemical Corporation,** Bound Brook, N. J. Since 1929 R-B-H has made a business of producing concentrated pigment dispersions for use in lacquers, synthetics, fabric coatings and so forth. More recently the plastic industry has been making use of these highly processed pigments principally for "tumble coloring" extruding compounds at the extruder.

★ ★ ★

**Advantages** for the extruder include:

**Freedom from pigment specks and streaking.**

**Color strength with minimum pigment.**

**Improved dielectric properties, because the compound contains less color pigment.**

**Economy, convenience and reduced inventory. Natural compound can be colored for around 1¢ per pound with R-B-H pigments against the usual premium of 5¢ or 6¢ for precolored compound.**

★ ★ ★

**Vinyl** dry blend compound can be efficiently and uniformly colored with the new R-B-H **Plastic Powders** —pulverized masterbatch dispersions of pigments in R-B-H Resin 510. Resin 510 is a thermoplastic, friable, hydrocarbon resin with good dielectric properties; it is completely compatible with vinyl as well as other thermoplastics including poly-


MEASURE FOOTAGE THE NEBUTTCO WAY

Nebuttco Wire Measuring Machines measure the footage of wire and cable, accurately, dependably. Built for heavy-duty, production service, these machines register the footage directly on an easy-to-read counter. Lengths up to 100,000 feet . . . nearly 19 miles . . . can be counted at one setting of the machine. Machines are supplied either with counter on right or left side, as needed, and are also available with electric predetermined counters.

Nebuttco Wire Measuring Machines are versatile, easily transferred from one job to another, easily adjusted to proper height for the job. Machine illustrated is made in two sizes — No. 1 for measuring wires to ⅝" diam. and No. 2 for wires to 1½". We also manufacture a small bench type machine for measuring any flexible material not over 5/16" diam.

**For complete specifications ask for Circular No. 1**

NEW ENGLAND BUTT COMPANY 1842

304 PEARL ST., PROVIDENCE 7, R. I., U. S. A.

ethylene, polystyrene, cellulose acetate and ethyl cellulose.

★ ★ ★

**A bulletin** and samples of both the Vinyl Extrusion Chips and Plastic Powders may be had for the asking.

### Announce Booklet on Application of Tin Coating Gage

**A new** 8-page booklet titled "X-ray Tin Coating Gage" is available gratis from C. J. Woods, **Research & Control Instruments Division, North American Philips Company, Inc.,** 750 South Fulton Avenue, Mount Vernon, N. Y.

★ ★ ★

**Reprinted** from a trade publication and written by technologists of a large steel company, the article explains operating principles and gives complete application details covering a new X-ray instrument used for measuring the thickness of coatings on steel plate. The booklet is illustrated with many photos, drawings, graphs and tables.

### Philips Announces Folder on X-Ray Spectrometry

**A new** 4-page folder titled "X-Ray Techniques. Can Help You Solve Your Materials Problems" is available gratis from C. J. Woods, **Research & Control Instruments Division, North American Philips Company,** 750 South Fulton Avenue, Mount Vernon, N. Y.

★ ★ ★

**The** folder contains a technical article from a national trade publication that describes X-Ray spectrometry with automatic chart recording as an important tool for solving today's material problems.

★ ★ ★

**Illustrated** with drawings, charts and photos, the folder clearly and concisely presents to the reader all important details concerning operating principles and uses of this x-ray technique which handles many difficult laboratory and production line tasks accurately in a matter of minutes.

### Dillon Electrical Indicating Dynamometer

**The** latest addition to the Dillon line of traction dynamometers has been announced. This is known as our Model "EL" and can be made to operate electrical warning signals, relays, motors, switches, etc. It can be set for any loading point between 0 and 100,000 lbs. Pertinent specifications are as follows:

**13 different capacities from 0-500 lbs. up to 0-100,000 lbs.**

**5″ or 10″ diameter dial optional.**

**Provided with red max. hand.**

**Dial protected with shatterproof safety glass crystal.**

**Overload protected.**

**Furnished with shackles and attachment pins.**

**Rust proof and moisture proof.**

**Compact. 0-500 lb. model weighs only 8½ lbs.**

**Individually calibrated for maximum accuracy.**

### Western Electric Reorganizes Manufacturing Set-up

**The Western Electric Company,** 195 Broadway, New York City, has announced a reorganization of its manufacturing divisions into eastern and western divisions, with **A. B. Goetze,** Vice President and Manager of the Kearny Works, Kearny, N. J., as head of the Eastern Division and **Reese F. Clifford,** who occupied a similar post at the Hawthorne Works, Chicago, Ill., as head of the Western Division. **Clyde C. Randolph** is Works Manager at Hawthorne with **Noble Armstrong** serving as his assistant.


AA POINTS THE WAY to
*lower wire wrapping costs*

...by recommending
*"Arksafe"* CRINKLED KRAFT WIRE WRAP

**For a tighter, more compact wrap!**

**Easy to handle, simple to apply. Uniform crepe — Strong and *Economical*, too!**

**CONSTRUCTION: Single ply, waxed, asphalt laminated and reinforced.**

**In Standard Rolls and Widths for use on all types of wrapping machines. Also available in Hand Rolls.**

**For details write Dept. WP-1.**

ARKELL SAFETY BAG COMPANY
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## Bulletin Explains Why Metals Corrode

**Reynolds Metals "Technical Advisor"** Number 19, recently published, carries the concluding section of a two-part article explaining the reason why metals corrode. Cathodic protection, which makes it possible to reduce or entirely prevent corrosion, is also explained.

★ ★ ★

This issue also carries the first article in a new series on "Finishes for Aluminum", taken from Reynolds technical manual on this subject.

★ ★ ★

**Also** featured in this issue is the amazing 10,000-ton installation of all-welded aluminum bus bars at Reynolds' new San Patricio reduction plant, Corpus Christi, Texas. This is probably the world's largest installation of aluminum bus bars. All permanent connections are welded, thus proving the practicability of welding large-sized aluminum bars. Each bar measures 1½ inches thick, 10 inches wide. The new shielded inert-gas metal-arc method was employed.

★ ★ ★

**The** question-and-answer section in this issue covers a number of subjects including cleaning architectural aluminum surfaces, alloy recommendations for aluminum castings contacting nitric acid, and sodium bisulfite; an explanation of why certain welds turn black and how to prevent it; a new black finish for aluminum; and use of stainless steel bolts for aluminum cable clamps.

★ ★ ★

**Any** engineer or technical man will gladly be sent a copy of the current issue and be placed on the mailing list to receive subsequent copies by writing on company letterhead to Reynolds Metals Company, 2500 South Third Street, Louisville 1, Kentucky.

★ ★ ★

## New Fastening Gun Speeds Cable and Tube Installations

**Swift,** easy and economical installation of cables and hollow tube lines is provided by a revolutionary new hand-held, automatic fastening gun developed by **The Heller Stapler Company** of Cleveland, Ohio.

★ ★ ★

**This** compact machine is operated with one hand, leaving the other hand free to guide the lines being installed. Yet it packs the power of a big industrial stapler. Its unusual force will drive bands around cables and tubes into hard or soft woods, plaster walls, flooring, joists and even mortar joints and cinder or mineralite building blocks.

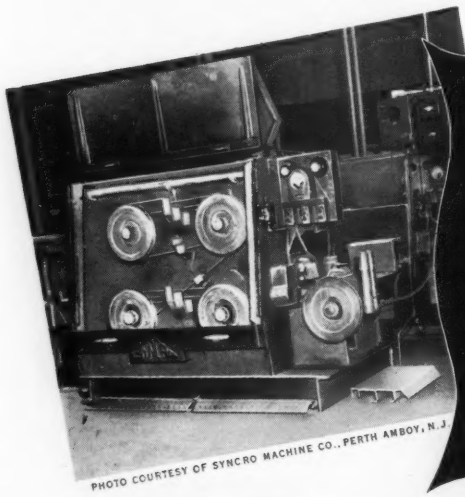
★ ★ ★

**The** new Heller fastening gun, instead of using ordinary width staples, drives a special Heller extra-size band with leg lengths varying from 3/16 to ½ inch.

★ ★ ★

**This** Heller cable fastener is now in use for installation of coaxial cable lines, copper tubing, thermostatic controls, juke boxes, music and intercommunication systems, gas refrigeration and incinerator units, chemical flow controls, transformer separators and many types of heavy wiring.

★ ★ ★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## Abstracts

ON THE EFFECT OF DIE PROFILE ON STRESS DISTRIBUTION AND CRITICAL DEFORMATION IN WIRE DRAWING.
Erich Siebel (Stahl u. Eisen, 1951, 71, (16), 801-805).

**The additional shear stresses at the beginning and end of the deformation zone produce an irregular distribution of drawing force over the cross-section of the wire. The drawing stress is thus at a max. in the centre of the wire, decreasing parabolically towards the circumference. If drawing conditions are not correctly chosen, the wire may break, because either the drawing stresses in the centre attain the max. stress or the max. stress equals the rupture strength of the wire. The manner in which the drawing stress at the centre and the max. stress are influenced by the die shape and the reduction in cross- section is examined.**

★ ★ ★

CONFIGURATION AND MEASUREMENT OF THE DIE.
Victor Domes (Stahl u. Eisen, 1951, 71, (22), 1147-1148).

**A light-reflection method is described for measuring the longitudinal section of the die and for checking worn dies. The relationship between such changes and the angle of entry of the die is mentioned.**

★ ★ ★

TEMPERATURE MEASUREMENTS IN WIRE DRAWING, USING A WIRE/DIE THERMOCOUPLE.
Werner Lueg (Stahl u. Eisen, 1951, 71, (22), 1140-1147).

**Drawing tests under different conditions were carried out on a patented steel wire and on a low-C wire rod. The temp. in the die hole was measured by a thermocouple formed by the hard metal of the die and the wire being drawn. Results show that this wire/die thermocouple is suitable for gaining an insight into temp. conditions during drawing. The max. temp. is not determined during drawing, but only a mean value of the temp. distribution in the die.**

★ ★ ★

CALCULATION OF DRAWING DIE DIMENSIONS FOR MULTIPLE-DRAW MACHINES.
W. Lueg (Arch. Eisenhuttenwesen, 1952, 23, Mar.-Apr., 95-101).

**The procedure given by E. L. Baay, for the graphical determination of intermediate die diameters for wire drawing on a multiple-draw machine with equal or varying reductions at each pass, described and developed. By introducing auxiliary scales, a further group of reference lines and a second nomogram field, a general diagram has been devised with which die diameters and all other characteristics may be rapidly and reliably determined for drawing processes with any type of sequence. The use of an ordinary slide rule for solving the same problems is fully described. The die diameter, individual and total reductions, increase of length and number of draws can be determined with a few movements only of the slide rule. Finally, relationships are derived from which to calculate the minimum reduction of a multiple-draw machine in which the speeds of the individual sheaves are fixed. It is shown that the smallest reduction of cross-section of such a machine is determined only by the ratio of the speeds of the first and last drawing stages.**

★ ★ ★

WIRE ROPE LUBRICATION
E. V. Paterson, Sm. 8vo, pp. xii + 34, Illustrated, Wellington Shropshire, 1952, Scientific Publications.

**This is a small but useful publication which stresses the importance, both for safety and for long life, of the lubrication of wire ropes, especially in mine shaft and roadway haulage. Illustrations of the sections of complicated lays illustrate the difficulty and the necessity of ensuring that the lubricant penetrates fully, reducing friction between the strands and maintaining the flexibility of the core. Proprietary automatic lubricators are shown, as well as the apparatus which can be contrived "on the spot," and employed as opportunity arises. A brief bibliography is included.**

★ ★ ★

## Industrial X-Ray Unit Saves Time, Money for California Plant

**A new** 250-kv industrial x-ray unit recently installed in the Sunnyvale, California, plant of **Westinghouse Electric Corporation** is expected to pay for itself in less than five years through savings on rental of radium alone. In addition, the machine can x-ray specimens 50 to 60 times faster than was previously possible using either radium or radioactive cobalt.

★ ★ ★

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**The** unit, built by Westinghouse, will be used to explore castings and weldments for internal defects such as shrinkage, cracks, porosity, and so forth.

★ ★ ★

**Steel** castings and weldments up to six inches inches in thickness can now be radiographed with ease. Specimens up to 2½ inches thick are x-rayed by the machine. Castings and weldments from 2½ to 6 inches thick are x-rayed using radioactive cobalt, which is much less expensive than radium.

## Public Report on Aluminum Conductor Results From Copper Shortage

**To** answer the pressing need for accurate information about aluminum electrical wire and cable, the National Electrical Contractors Assn. has published a highly readable message to the public, "Report on Aluminum Electrical Conductor." It was prepared with the aid of the electrical industry and government construction agencies, because of the tremendous demand for aluminum as a replacement for copper, touched off by the Korean War.

★ ★ ★

**For** example, the scarcity of copper, particularly for non-defense needs, caused the Federal Security Agency to push the use of aluminum wire in school construction. The agency and The Thomas & Betts Company, a pioneer in the development of aluminum wire and cable connectors, were two of the organizations that made important contributions to the **NECA** report.

★ ★ ★

**Since** aluminum is not as well understood as copper for electrical uses, the report points out the problems involved and what can be done about them. It also explains the factors that govern the choice between aluminum and copper in electric wire, cable and bus.

★ ★ ★

**The NECA** says that reports from various parts of the country also showed a need for an understanding of the white metal among contractors and electricians. According to the association, the electrical industry, after much study, discovered that aluminum was a very good substitute for copper as a conductor provided that its characteristics were taken into account.

★ ★ ★

**Most** serious problem in using aluminum electrical conductor is that of connecting it, the report states. Consequently, two of its six pages contain a discussion on connecting aluminum wire and cable by Martin D. Bergan, director of research for The Thomas & Betts Company.

★ ★ ★

**In conclusion** the report advises that the choice of aluminum or copper electrical conductor be based on over-all cost and the use for which it is intended.

★ ★ ★

**Copies** of "Report on Aluminum Electrical Conductor" are available from **NECA** or The Thomas & Betts Company, Elizabeth 1, New Jersey.

★ ★ ★


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### Expansion Goals Set for Copper Wire Mill Facilities

**Four** defense expansion goals were announced here by the Defense Production Administration. They are for specified types of inland waterways vessels, diesel locomotives, copper wire mill facilities, and strategic grades of asbestos.

★ ★ ★

**An** interim expansion goal for facilities to produce copper wire mill products has been set at $15,000,000 capital investment. The goal is limited to expansion projects started on or after January 1, 1951 to be completed on or before December 31, 1953. It includes production facilities for specialty wire and specialized military-type wire products. For this goal, about $11,000,000 rapid tax amortization certificates of necessity have been issued or are in process.

### Buys West Coast Rivet Concern

**Milford Rivet & Machine Co.**, Milford, Conn., manufacturer of tubular and split rivets, cold-headed fasteners, and rivet-setting machines, has purchased Pacific Rivet & Machine Co., Alhambra, Calif. This brings to five the number of plants owned and operated by them. Operating as the Pacific Division, the plant will manufacture tubular rivets, cold-headed specialties and rivet-setting machines.

### Adopts New Trade Name

**"Nepconol"** is the new trade name that National Electric Products Corp., Pittsburgh, has selected to designate its expanded line of thermoplastic insulated wires and cables, including building wires. It replaces the former trade name of "Ne'on" which had been used to identify its building wires.

### Western Sales Manager Appointed by International Paper

The appointment of **D. H. Kennedy** as Western Sales Manager, **International Paper Company**, Southern Kraft Division, succeeding the late Raymond Bee, was announced recently by **R. C. Doane**, Vice President in Charge of Sales.

★ ★ ★

**Mr. Kennedy** joined International Paper Company at the Camden (Arkansas) Mill in 1936. He transferred to the Sales Department in the Chicago Office in 1938 and in 1948 was appointed Assistant to the Western Sales Manager for the Southern Kraft Division.

☆ ★ ★

**Mr. Doane** also announced the appointment of J. D. Dooley as Assistant Western Sales Manager—kraft linerboard sales, and N. P. Sparkman as Assistant Western Sales Manager—kraft paper and bag sales.

### Two Wire Men Join Controllers Institute

**Allyn K. Suttell**, vice president and controller, **Collyer Insulated Wire Company**, Pawtucket, R. I., and **Charlton W. Smith**, comptroller, **Southern Electrical Corporation**, Chattanooga, Tenn., have been elected to membership in the Controllers Institute.

★ ★ ★

**Established** in 1931, the Institute is a non-profit organization of controllers and finance officers from all lines of business. The total membership exceeds 3,900.


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This unit is also available with an oil heated extruder.

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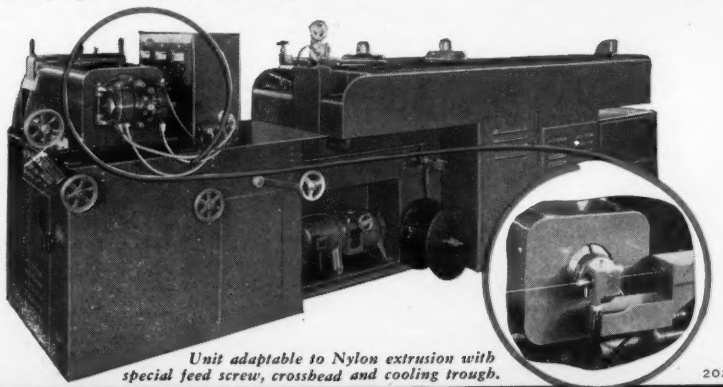

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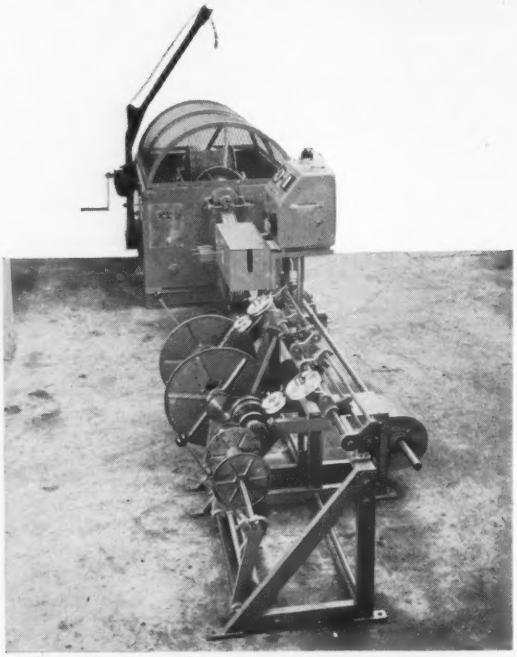

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  - —Lays from 2" to 6"
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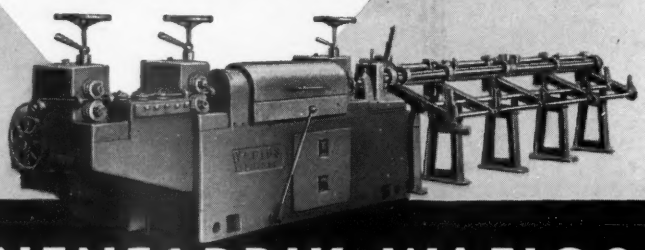

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## Personalities

(*Continued from page* 1095)

### Kenneth J. Gillett Established in Sales Office in East

**Kenneth J. Gillett,** who resigned from Industrial Ovens, Inc., recently, where he was vice president, has become a sales representative for the Michigan Oven Company and the Eclipse Fuel Engineering Company in the northern New Jersey and eastern New York territories. His headquarters are at 30 South Broadway, Yonkers, N. Y.

★ ★ ★

### Frank J. Leeming Joins Sprague Electric

**Addition** of **Frank J. Leeming** to the application engineering staff of the **Sprague Electric Company,** North Adams, Mass. has been announced by **Julian K. Sprague,** Vice President.

★ ★ ★

**Mr. Leeming** will specialize in customer manufacturing problems in the high-temperature magnet wire field as he has had wide experience in the design of miniature components, such as transformers, motors, and inductances, using Sprague Ceroc Wires.

★ ★ ★

**Prior** to joining Sprague, he was with the Eclipse-Pioneer division of Bendix Aviation Corporation as project engineer, and with the Chance-Vought Corporation.

★ ★ ★

### Becomes General Manager of Inco Plant

**E. M. Kline** has been promoted to general manager of the Huntington, W. Va., works of The International Nickel Co., Inc. His former position was that of assistant general manager, a position to which **G. K. Crosby** has been appointed. Mr. Kline has been with International Nickel at the Huntington works since 1923 when he began as assistant chief chemist. He was appointed chief chemist in 1926 and works technical director in 1939, becoming assistant general manager in 1947. Mr. Crosby joined International Nickel in 1936 as a metallurgist and successively became combustion engineer, assistant to the general manager, superintendent of production and general superintendent.

★ ★ ★

### D. G. Clark Advanced by Firth Sterling

**D. G. Clark** has been appointed assistant general sales manager of **Firth Sterling, Inc.,** Pittsburgh. His association with the company began in 1903 and continued until 1946 when he retired from active management but remained as consultant on sales until 1950. He has been succeeded in the position of steel sales manager by **E. William Kalb,** who was formerly assistant manager of the steel sales division.

★ ★ ★

### Made Officer of Goodrich

**Elmer A. Stevens** of Akron, O., became Treasurer of the **B. F. Goodrich Company** September 1, according to an announcement by **John L. Collyer,** president.

★ ★ ★

**Mr. Stevens** joined B. F. Goodrich in 1928 following his graduation from Yale University Sheffield Scientific School where he received his degree of Bachelor of Science in Chemical Engineering.

★ ★ ★


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He was first assigned to the company's rubber processing division, served in the general chemical laboratories, and in 1929 became a member of the raw materials department.

★ ★ ★

In 1930 he entered the purchasing division as a crude rubber buyer, and in 1933 joined the B. F. Goodrich staff in the Far East, returning to the United States in 1936.

★ ★ ★

In 1940 he became managing director of Goodrich Company, Ltd., Singapore, returning to Akron in 1942 as assistant to the director of purchases, being named director of purchases in 1947.

★ ★ ★

### Made Assistant General Sales Manager

**National Electric Products Corp.**, Pittsburgh, has appointed **Luther D. Shank** as assistant to **R. C. Bennett Jr.**, vice president and general sales manager. In addition he will be in charge of Pittsburgh district sales. Mr. Shank retired recently as director of **NPA's** electrical division.


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### Hooker Appointments

**Hooker Electrochemical Company** announces the appointment of **Horace W. Hooker, Jr.** as Assistant to the General Sales Manager, **Peter N. Maclaren** as Purchasing Agent and **Robert F. Schultz** as Assistant Technical Superintendent.

★ ★ ★

**Mr. Hooker** has been associated with the company since 1934, when he was employed in the Development and Research Department. From 1940 to 1941 he was Assistant to the Sales Manager, and in this capacity was in charge of sales promotion and advertising. In 1941 he became Assistant Purchasing Agent and in 1947, Purchasing Agent. Mr. Hooker was graduated from Cornell University in 1928 and was employed by the New York Telephone Company as a commercial sales representative from 1929 to 1934.

★ ★ ★

### Naugatuck Chemical Appointments

**Appointment** of **Dr. Wesley S. Coe** as assistant factory manager of the Naugatuck, Conn., plant of Naugatuck Chemical Division, United States Rubber Company, was recently announced by **Philip E. Rice**, factory manager.

★ ★ ★

**Dr. Coe** joined the company at its general laboratories in Passaic, N. J., in 1936 after receiving his doctor's degree in chemistry at the University of Illinois. He transferred to Naugatuck Chemical in 1937 and served in the research and development department as senior section leader in process development. Immediately prior to his new appointment, he was chemical production superintendent and assistant to the factory manager.

★ ★ ★

**Herbert Scullin** has been named to succeed Dr. Coe as chemical production superintendent. Mr. Scullin joined Naugatuck Chemical in 1935. He served successively as foreman, general foreman, assistant superintendent in the chemical production department and labor relations supervisor in the industrial relations department.

★ ★ ★

### Paul B. Greenawald

**Paul B. Greenawald,** vice president in charge of production of the **Carpenter Steel Company** and also a director of the company, died early in September in the Reading Hospital. He was 58.

★ ★ ★

**Mr. Greenawald** entered the employ of the Carpenter Steel Company in 1924 as a metallurgist. In 1945 he was promoted to general supervisor and shortly afterwards became vice president. He was a member of the American Iron and Steel Institute.

★ ★ ★

**He** graduated from Pennsylvania State College in 1920, with a degree in metallurgical engineering.

★ ★ ★

**His** college career was interrupted by World War I, during which he served as an officer in Army Ordnance. After the war he was employed by the American Steel & Wire Company, Worcester, Mass., until he entered the employ of the Carpenter Steel Company.

★ ★ ★

### Becomes Assistant Manager of G.E.'s Industrial Heating Dept.

**John D. Seaver** has been made assistant manager of engineering of **General Electric Co.'s** industrial heating department at Schenectady, N. Y. After receiving his B.S. degree in physical metallurgy from Massachusetts Institute of Technology in 1935, Mr. Seaver became one of the initial candidates in the G. E. chemical and metallurgy program. Later he joined the staff of the meter and instrument laboratory where he worked in metallurgy until his appointment as engineer in 1947.

★ ★ ★

### Inco Man Elected Member of Welding Research Council

**T. H. Wickenden,** Vice-President in Charge of Development and Research of **The International Nickel Company, Inc.,** has been elected a member of the Welding Research Council of the Engineering Foundation for a three-year term beginning October 1.

★ ★ ★

### Made Staff Engineer of Chase

**President R. C. Diehl** of the **Chase Brass & Copper Company** has announced the appointment of Charles W. Yarrington to the position of staff engineer.

★ ★ ★

**Mr. Yarrington,** who is a graduate of the University of Michigan, will report to the director of engineering. He comes to Chase Company from the McCook plant of Reynolds Metals Company at McCook, Ill. He previously served the Reynolds Company at their Sheffield, Ala. plant as engineer and assistant plant superintendent. He became plant superintendent of the McCook plant when Reynolds commenced operations in that area in 1946.

★ ★ ★

### Promoted by Bohn

**J. L. Adams** has been promoted to assistant to the president of the **Bohn Aluminum & Brass Corp.,** Detroit. At the same time **Raymond C. McCullough** was named divisional sales manager and **Richard C. Aylward** named manager of their Chicago office.

★ ★ ★


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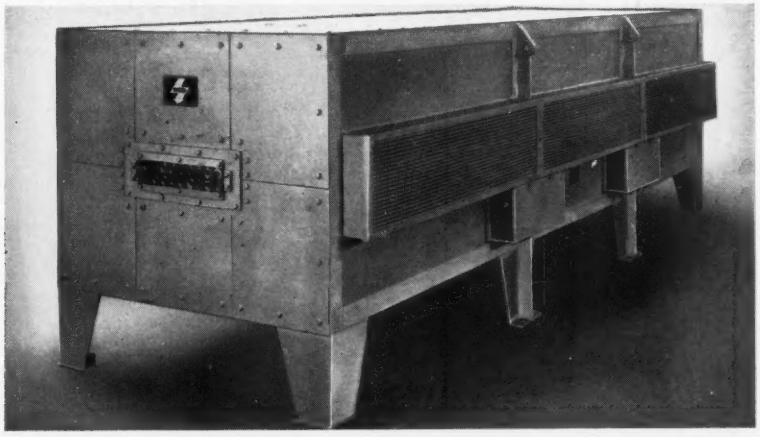

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**1775 Broadway, New York 19, N. Y.**

### Thompson Wire to Build Plant

**A** new industry for Baltimore, **Thompson Wire Co.**, will begin construction immediately on the 25 acres of land it purchased at Sparrows Point, Md. The Baltimore Association of Commerce rates this plant as one of the largest that has come into the Baltimore area since the new industry location program of the Industrial Bureau was inaugurated three years ago. Thompson Wire Co., Boston, is one of the leading independent firms in the field of strip steel and fine specialty wires.

★ ★ ★

### New Bulletin on Surface Active Agents

**Prepared** as a guide to speed processing and lower production costs, a new 8-page bulletin, "Surface Active Agents for the Metalworking Industry", has recently been issued by **E. F. Houghton & Co.**, of Philadelphia.

★ ★ ★

**Based** on years of study by Houghton's Research Staff, this bulletin lists many metalworking applications where efficiency can be improved and time and costs cut simply by the addition of a very small percentage of a surface active agent.

★ ★ ★

**One** page of reports from users lists benefits gained in actual production and contains helpful suggestions for other applications. A chart outlining the physical properties of the leading surface active agents in Houghton's Cerfak and Surfax lines serves to help in selecting the proper product for various needs.

★ ★ ★

**For** a free copy of "Houghton's Surface Active Agents for the Metalworking Industry" write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

### Detroit Steel's Expansion Program to Proceed

**Detroit Steel Corporation** has consummated the $45 million Reconstruction Finance Corporation loan authorized June 16, 1952, it was announced by M. J. Zivian, President.

★ ★ ★

**Mr. Zivian** added that the initial take-down under the loan was used to retire the corporation's first mortgage bonds due February 1, 1965. The balance will be taken down as required to complete the corporation's $58 million expansion program now in progress at its Portsmouth, Ohio plant.

★ ★ ★

### Anaconda Expands on West Coast

**Anaconda Wire & Cable Co.**, New York, is completing a $700,000 expansion program at its Orange, Calif., mill. The project is expected to increase production of copper products at that plant by 15 per cent. It involves the construction of a 40,000 sq. ft. factory building, the revamping of the electrical power system, and the installation and rearrangement of $250,000 worth of mechanical equipment. The wire mill will consist of over 40 machines for drawing and processing copper wire from fine sizes up to 3 in. in diameter when stranded.

★ ★ ★

### Reynolds Expanding Rod Plant

**Reynolds Metals Co.** has started another expansion of its plant at Listerhill, Ala. Ground has been broken for a new $1.5 million merchant mill to roll aluminum rods and angles. It is scheduled to be completed Jan. 1, 1953.


EW

**HIGH PRODUCTION METAL LOOMS**

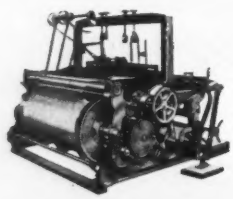
**S.A.M.P.**

*Type BM* for mosquito & fly nets, paste factories, armour plate glass, corn sieves, etc.

*Type XL* for flour mills, chemical and industrial works, etc.

*Type CP* for "Rabitz" cloth, plastering work, armour plate glass, etc.

*Type CM* for extra strong metal cloth for sieves, grain, rice, armour plate glass.



**Jarach-Guetta, Industrial Overseas Co., Inc.**

120, Wall Street, New York 5, N.Y.

General Agents of EMILIO WARTENWEILER,

Via Pergolesi 18, MILAN (Italy)

## New Clip Splicing Method Simplifies Wire Patenting Operation

**Manco Mfg. Co.,** Bradley, Illinois, announces the development of their new Model R-210-187E Guillotine Splicer Unit and Splicer Clips. Manufacturer states that this new equipment offers users the fastest, most efficient, and lowest-cost way to connect the wire ends of coils for drawing through patenting furnaces.

★ ★ ★

**To connect** the ends of coils, operator merely slips wire end into Manco Splicing Clip, inserts loaded clip into Manco Splicer, and straightens clip by means of thumb button operated hydraulic pressure, thus effectively locking wire to clip. Connecting operation is completed by repeating procedure with other wire end. Clips are cut off after patenting operation.

★ ★ ★

**The following** important advantages are claimed for the wire splicing equipment: 1) elimination of heating and manual bending; 2) elimination of tied ends; 3) precludes need for welding equipment, thus eliminating problem of weld crystallization in patenting; 4) heat number of coil can be stamped on clip, providing positive quality control; 5) equipment is readily used in latest type tube furnaces; and 6) speed and ease of use.

★ ★ ★

**New** Splicer Unit has an available thrust of 10 tons. Operating cycle is one second. As stated above, unit is activated by convenient thumb-button valve control—press for splicing action, release to retract. Unit operates from a 2 h.p., 220/440 volt, 3-phase, 60-cycle motor driving hydraulic pump. Pump comes complete with 25 feet of hydraulic hose. Spring tension balancer is available for unit, if desired, at additional cost.

★ ★ ★

**Manco** Splicing Clips are available in two sizes: the No. 1 Clip, 7/32" maximum wire capacity, and the No. 2 Clip, ½" maximum wire capacity. Manco states that new clips are completely positive in action and that they remain tight and firm under the 1500° - 1800° temperatures and extreme tension encountered in the patenting operation.

★ ★ ★

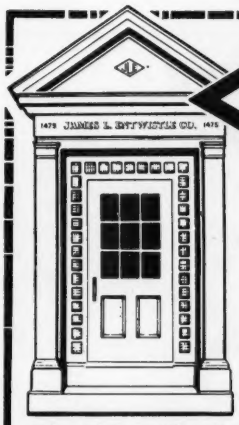
**For** additional information and prices on these products, write to the Manco Mfg. Co., Bradley, Illinois.

## Adds 34 to Industrial Division Sales

**Thirty-four** sales engineers were recently added to the field sales force of **Minneapolis-Honeywell Regulator Company's** industrial division, it was announced by **O. B. Wilson,** field sales manager.

★ ★ ★

**The new** appointees, all recent graduates from the company's industrial instrument training school in Philadelphia, mark an over-all increase of 15 per cent in the field sales group this year. He pointed out that since 1946 additions to the company's field sales group have virtually paralleled industrial expansion, which has pyramided from nearly $13 billion in 1946 for new plants and equipment to an expected all-time high total of slightly more than $24 billion this year.

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SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Caterpillar Pull-outs
- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Shaftless Take-ups and Payoffs
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Special Machinery for the Wire Industry
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See pages 1008 through 1014 for New Equipment added to the JLE Line.

JAMES L. ENTWISTLE CO.

1475 ELMWOOD AVE. PROVIDENCE 7, RHODE ISLAND, U. S. A.

*European & South American Agents:* M. CASTELLVI, INC. 150 BROADWAY, NEW YORK 38, NEW YORK

*British Associate:* GENERAL ENGINEERING CO., LTD. BURY ROAD, RADCLIFFE, LANCASTER, ENGLAND

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SPARK TESTERS

FLYER and TENSION PAY-OFFS

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BARE WIRE DRAWING and TAKE-UP MACHINES

**FEDERAL equipment is designed to take reels up to 42" diameter.**

**First cost is low, deliveries are prompt, construction is the best.**

*Write today for full details.*

**ALSO —**

- *MEASURING MACHINES*
- *SPECIAL TESTING EQUIPMENT*
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Federal Manufacturing Co.

SPECIAL WIRE MACHINERY

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Die Gard 34

One of a series of compounds for drawing metals, Die Gard 34 is unexcelled for wet drawing of non-ferrous wire in the rod and intermediate size range. We can give you figures showing production results which are pleasing. Wire, Phone, or Write.

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BASIC REFINERS OF FATTY OILS

REILLY ★ WHITEMAN ★ WALTON Company

CONSHOHOCKEN, PA.

## Principles of Extrusion Discussed by Du Pont Research Team

**A six-man** Du Pont research team recently disclosed significant advances in plastics manufacturing know-how which point the way to improvements in processing many of the plastics products used in American home and industry.

★ ★ ★

**The** team's findings, reported to the 122nd national meeting of the **American Chemical Society**, will make it possible for manufacturers, without investing in expensive laboratory equipment, to improve the design and productivity of extruding machines.

★ ★ ★

**A host** of products, such as the new plastic piping or insulation on electric wire, is made in extruders in which melted material is forced through openings having the shape of finished articles.

★ ★ ★

**Basic principles** of the machines' operation, as one of the research men pointed out, are little known and wide differences of opinion exist in the industry about how they should be designed and run. As a result, said **Wilbert L. Gore**, extrusion machinery is producing "far below ultimate capacity."

★ ★ ★

**Although** the research program, now two years old, was admittedly no more than a good beginning toward complete understanding of the extrusion process, with many problems considered only superficially and others totally unexplored, it was clear from the scientists' eight papers that progress had been made in correlating the theory of plastic extrusion with practice, through the application of mathematical equations or experiments in relatively inexpensive model machines.

★ ★ ★

**What** the researchers did, essentially, was to arrive at a better understanding of the basic theory of extrusion from the scientific literature and by evolving new ideas of their own; derive mathematical equations for determining how melted plastics behave as they flow through an extruder; and make practical applications of theory and equations by experiments in a scale model and a full-sized machine.

★ ★ ★

**As an example** of the practicality of the research, one of the papers showed how, simply by designing a new screw, it would be possible to increase the capacity of an extruder already operating at top speed without changing the size of barrel or die. This paper, by Dr. James F. Carley, Robert S. Mallouk and Dr. James M. McKelvey, coupled details of a simplified theory for screw extruders with actual figures on design improvement.

★ ★ ★

**A paper** by **Mr. Mallouk** and **Dr. McKelvey** showed how the power consumption of melt extruders could be calculated mathematically, while a paper by **Dr. Rene A. Strub** and **Dr. Carley** related equations and theory to the design of low-powered machines.

★ ★ ★

**A paper** by Dr. Carley and Dr. McKelvey disclosed that data on the operation of plasticizing extruders, of especial importance to the industry, could be obtained by calculations made from studies of a small-scale model of a melt machine.

★ ★ ★


FOR LONG RANGE SAVING . . .
AN INSTANT SOLUTION TO
CORROSION PROBLEMS . . .

. . SPECIFY HAVEG PICKLING TANKS

Round, molded HAVEG tanks like this can take hard knocks, need no extra care. Boiling sulfuric acid and water have no effect on tough, corrosion resistant HAVEG.

PRODUCTION INCREASED
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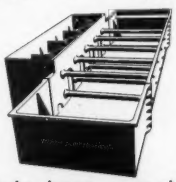
Here's good news! You can get the best . . . HAVEG pickling equipment . . . so that economies are immediate. Why use a substitute when proven HAVEG is available?

HAVEG IS A STRONG MATERIAL MOLDED TO YOUR ORDER



Stop leaks, improve your pickling facilities with one-piece, seamless, jointless HAVEG tanks. HAVEG is not a lining or a coating; it is a solid tank constructed of a molded plastic that is acid resistant *throughout*.

Bulletin F-6, a valuable 64-page manual telling *all* about HAVEG. Photos, sizes, details about the ideal material for pickling tanks.

START NOW . . . write for the HAVEG book . . . call your HAVEG sales engineer . . . if you pickle or clean metals, HAVEG can help you beat corrosion.

RESISTANT FOR YEARS TO ACIDS, SHOCK, AND HEAT

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| Hartford 6-4250 | Jackson 6840 | Mutual 1105 | Hemlock 1351 |

**In a** final paper, **Carl H. Jepson** discussed extrusion problems for future research.

### New Single Face Flat Lapping Machine

**This** new machine, made by **Norton Company,** Worcester 6, Mass., is equipped with a 60" diameter segmental type bonded abrasive lap, to provide a superior means for lapping large parts. It is outstandingly efficient for lapping soft metal parts because it produces a clean, finished surface that is free from grit either embedded or trapped in pores or crevices in a minimum of time.

★ ★ ★

**This** important advantage of producing a uniquely clean surface on soft metal parts makes it possible to lap these to provide seal surfaces, wear surfaces, or surfaces to be subsequently drilled or milled—without an immediate cleansing of the parts after lapping to remove all traces of embedded abrasive.

★ ★ ★

**An** additional advantage provided by the bonded abrasive lap of this machine is the production of bright surfaces that require no subsequent polishing operation. This advantage is pronounced where soft metals must be produced with a bright finish.

★ ★ ★

**The** machine provides extreme accuracy because the accuracy of the product is controlled by the truing device. The original accuracy is maintained throughout the life of the lap by a simple diamond truing operation at infrequent intervals. The life of the bonded abrasive lap is considerable, and replacement is easy, as the lap is segmental and convenient to attach.

### Hydraulic Cylinder Catalog

**A new** 28 page two color Bulletin No. 701 on Lindberg Hydraulic Cylinders has just been released.

★ ★ ★

**This** bulletin describes the complete line of Hydraulic Cylinders manufactured by the Air and Hydraulic Cylinders manufactured by the Air and Hydraulic Division of Lindberg Engineering Company of Chicago, Illinois.

★ ★ ★

**Diagrams,** photos and charts explain the different mounting types and capacities of Lindberg Hydraulic Cylinders up to 1500 P.S.I. and 3000 P.S.I. working pressure.

★ ★ ★

**You** may secure a copy of this reference book from **Lindberg Engineering Company,** 2443 W. Hubbard Street, Chicago 12, Illinois.

★ ★ ★


***A BOOK EVERY WIRE MAN SHOULD OWN AND READ . . .***

●

**"STEEL WIRE IN AMERICA"**

●

written by Kenneth B. Lewis, as only he can write. This remarkable book treats of the various operations in wire making, giving the history and theories underlying each process, tracing the development of machinery, equipment and supplies used in the industry, and naming those individuals and companies involved in the evolution of our industry to its present stage of development. A highly readable treatise. You'll like it!

The book, sponsored by the Wire Association, is an unusual contribution to the literature on the art of making wire. It is not a handbook nor reference work, but is one that will bear much reading, re-reading and study. Any wire man will be better equipped for his work through a knowledge of the contents of Mr. Lewis' book.

The edition is limited and orders can be filled only as long as the small supply lasts.

**THE PRICE: $15.00**

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Send your order today to assure yourself of a copy.

**BOOK DEPT., THE WIRE ASSOCIATION**

**453 Main Street**

**Stamford** **Conn.**

## Synthetic Rubber Plant Observes 10th Anniversary

**The Naugatuck Chemical Division, United States Rubber Company,** is taking note of the tenth anniversary of the Naugatuck Synthetic Rubber Plant at Naugatuck, Conn.—one of the first synthetic rubber plants constructed in the United States.

★ ★ ★

**Because** of the urgent wartime need for synthetic rubber, the plant was designed, built and put into production by the company almost entirely on the basis of laboratory research with but brief pilot plant experience. Eighteen months after it was completed, the plant was producing more than 2,500 tons of synthetic rubber a month and by 1945 was producing rubber at the rate of 42,000 tons annually.

★ ★ ★

**Since** the war, the plant has concentrated on the production of new types of synthetic rubber. It produces a superior type of rubber for wire insulation which is in large demand from the wire industry. Much of the initial research and development work in "cold" rubber was accomplished at Naugatuck and Naugatuck scientists led the way in the development of "cold" synthetic rubber latex. About 60 per cent of the plant's current production is latex for use in foam mattresses, brake linings, packing materials, dipped products and tire cord.

★ ★ ★

## New Reliance Products Booklet Issued

**A 4-page,** quick-reference bulletin, describing and illustrating its principal products, has just been issued by the **Reliance Electric & Engineering Company,** Cleveland, Ohio, and is now available for general distribution to those interested in motors and related in-plant power-transmission equipment.

★ ★ ★

**The** booklet, identified as Bulletin A-2703, gives capsule digests of Reliance Precision Built A-c. motors from ¾ to 300-hp.; heavy-duty Type "T" D-c. motors from ¾ to 1000-hp.; the all-electric Reliance adjustable-speed (V*S) drive for A-c. circuits, from ¾ to 300-hp.; electronic controls and regulators for this motor-drive system; and Reliance motor-generator sets, generators, and rotating-type regulators.

★ ★ ★

**Many** functions and advantages of each product are included, service applications for which they are designed are indicated, and representative units illustrated. Copies are available on request. Write to the Reliance Electric & Engineering Company, 1088 Ivanhoe Road, Cleveland 10, Ohio.

★ ★ ★

## Surface Combustion Moves To New Offices

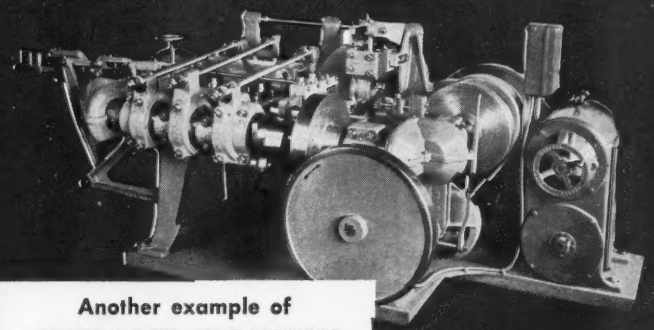
**Surface Combustion Corporation,** manufacturers of Industrial, Domestic and Commercial heating equipment, have moved to new offices at 10333 West McNichols Road, Detroit 21, Michigan. The firm, which has headquarters in Toledo, has maintained offices in Detroit for over a quarter of a century. The company manufactures Janitrol, domestic-commercial space heating equipment and 'Surface' industrial heat treating furnaces.

★ ★ ★

**Abner Baker** is manager of the Janitrol division district office and **Walter F. Herdrich** is manager of the Industrial sales district office.

★ ★ ★

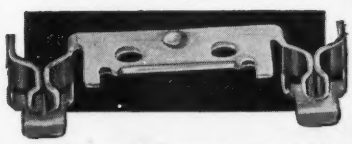

PRODUCTION RECORDS *Broken*
with NILSON 4-SLIDE *Machine!*



Another example of
**FASTER, LOWER COST FORMING**
**of Ribbon Metal Stock**

★ *180 Terminal Contacts* **Per Minute**

★ *7 Separate Operations* **Eliminated**



A famous national manufacturer tripled production of the Terminal Contact illustrated above (in actual size) and reduced production costs proportionately by replacing several progress die set-ups with one Nilson S-3-F four side machine. *Seven separate operations were eliminated;* 180 completed contacts produced per minute. Time required for tooling changes was reduced 50% over similar type machines.

**This example clearly shows the big savings you can make in overhead, maintenance, labor and time with a Nilson 4-slide!**

Taking stock directly from the coil, NILSON metal ribbon stock four-slide machines automatically feed, straighten, pierce, blank, swage, stamp, coin, cut off and perform up to five forming operations with speed and accuracy. Built in five models with capacities up to 2½" wide and feed lengths up to 15". For specific recommendations on your wire and ribbon metal forming problems, send details, prints or samples of your operation to us when you request the bulletin.

THERE'S NOTHING LIKE A NILSON

*Specialists in Wire Forming Equipment for Over 50 Years*

**THE A. H. NILSON MACHINE COMPANY**

1510-J RAILROAD AVENUE, BRIDGEPORT 5, CONNECTICUT

OTHER NILSON PRODUCTS:

- Automatic chain-making machines
- Automatic staple forming machines
- Wire and Stock reels
- Foot Presses
- Wire straightening equipment
- Slide Feeds for Presses

## Dry Blending for the Vinyl Extrusion Industry

(*Continued from page* 1052)

the front cylinder zone with better opportunity for the control of the stock temperature.

### 4. Die and Breaker Plate Design

**Longer** land dies may be necessary to obtain smooth surfaces on heavy walled extrusions and to help eliminate porosity. It is essential that head pressure be maintained and often the use of modified breaker plates have been found useful for this purpose. A breaker plate having full tapered holes in which the open area at the die end is decreased by 40-50 percent has been found to be effective in maintaining head pressure without recourse to a fine screen pack. This is particularly helpful in handling loaded stock without the danger of clogging screws, reducing output and frequent cleanouts.

### 5. Feeding Techniques

**Some** work has been carried out to determine the advisability of feeding preheated dry blends to the extrusion machines. In general preheating assists in obtaining better rates of output and in reducing porosity where high humidity conditions are encountered. It is paramount that uniform temperatures of the feed stock be maintained; otherwise, diameter control and other surge difficulties will be encountered. Electronic preheating and radiant heating methods have been suggested, as well as the feeding of the hot, dry blend directly from the blending equipment itself.

★ ★ ★

**To permit** uniform feeding of powder to the extruder the angle of repose of the hopper may have to be varied from that provided for the handling of granular compounds. Syntron and other vibratory feed devices are recommended. The use of adjustable, vibratory feed devices is also recommended. Controlled, measurable feeding can thus be maintained with the added advantage of minimizing any tendency for the dry blend to be lost by working back through the rear bearing.

★ ★ ★

**Successful** extrusion requires well dispersed, dry, free-flowing blends of sandy, rather than flour-like, consistency. The choice of resin will invariably govern this factor. The particle size of the resin, particle size distribution and bulk density will likewise assume importance in obtaining optimum quality and rate. Fillers are helpful in attaining dry, free-flowing blends. Plasticizers are chosen for properties of the product and not for processing.

★ ★ ★

**On all** designs of thermoplastic extruders dry blends as a class have invariably yielded higher production rates than are possible with diced compounds of the same formulations. This increase in output ranges from 10-50 percent with 25 percent being an average. With more efficient machine designs even higher rates are feasible.

★ ★ ★

**The** extrusion operation itself is a drastic one. There should be no holdup or stagnant areas in the barrel, breaker plate and screens, head and dies where resin can remain static and be subject to decomposition. Use of relatively small, streamlined crossheads with divided flow features has eliminated many of the objections encountered with the oversized heads furnished in the past on extrusion equipment.

*Convert Process Fumes to*

**USEFUL HEAT**

Eliminate visible smoke, offensive odors, duct condensate — with its fire hazard and cleaning problems — by CATALYTIC FUME COMBUSTION of exhaust gases from:

- **WIRE ENAMELING**
- **VARNISH COOKING**
- **PAINT BAKING**

and similar solvent or other hydrocarbon liberating processes.

***There may be possibilities of profitable recovery of heat energy.***

Hundreds of successful installations.
Representatives in principal industrial areas—domestic and foreign.

*Patents pending*

Catalytic *Fume Incineration for Industry*
COMBUSTION CORPORATION
4540 GRAND RIVER AVENUE DETROIT 8, MICHIGAN

**The use** of multiple screw machines with dry blends is a relatively new innovation. The full value of this type of machine in handling elastomeric dry blends has not been demonstrated. In rigid work multiple screw machines are of great promise.

★ ★ ★

**Excellent** strides made in dry blending in the past year have by no means reached the saturation point. With continued research and development it is expected that dry blending will become the predominant method for the compounding of elastomeric vinyls. In dry blending we have a method of compounding that will have far reaching effects on the future growth of the extrusion industry.

### New Norton Cylindrical Grinding Machine

**A new** heavy duty NORTON Type C-2 Cylindrical Grinder built as a Plain or Semiautomatic machine in 18″, 24″, or 30″ swing, and in work lengths of 48″, 72″, 96″, 120″, 144″, or 168″, provides the means for lowering costs in grinding large cylindrical work. In addition to a fast grinding action, the Type C-2 offers new features that reduce costs by simplifying setup and operation, and by requiring less maintenance.

★ ★ ★

**With** this new machine, setups are quickly made because all controls for feeds and speeds are adjusted at the front of the machine in the operating position. Actual operation of the Type C-2 is considerably simplified by several important features. One of these is the combination graduated wheel feed handwheel and "click-count" indexing mechanism which readily indicates the amount of feed as the wheel is rotated past a fixed pointer, and permits settings of .0001″ in work diameter instantly and without visual attention.

★ ★ ★

**Further** operating ease is provided by the pre-set truing and grinding speed arrangement. With this feature, table speeds for truing and grinding are independently adjustable and pre-set, and either speed is immediately obtained when desired, by movement of a combination selector and table start-stop lever. No resetting of these speeds is necessary in the change from one to the other. Work-jogging control by means of a lever conveniently located near the operating position is also provided.

★ ★ ★

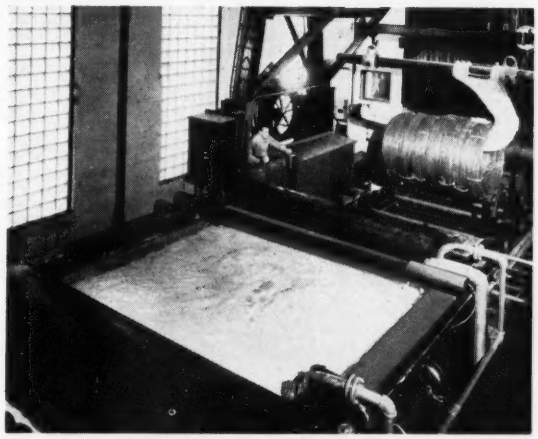
**Please** write the **Norton Company,** Worcester 6, Mass., for additional information.

### New Catalog on Corrosion-Resistant Equipment

**An** extensive, 64 page catalog of all equipment made by **Haveg Corporation** molded from a mixture of acid digested asbestos and synthetic resin. The bulletin gives grades of material, chemical resistance, electrical properties, standard pipes and fittings, with dimensions and illustrations, valves and pumps, fume ducts, tanks, towers, pressure and vacuum equipment, filters, accessories, agitators, agers and other equipment made by this company. In all cases specifications, description and pictures are included. Please write to the Haveg Corp., Marshallton, Delaware, for your copy of this catalog.


**To INCREASE Your Pickling Tonnage...**

**. . . Use HEIL Steam Jet Agitators**



*A typical wire mill pickler completely outfitted with HEIL E-3 Type Steam Jet Agitators.*

**The majority of pickling operations throughout this country and Canada have selected Heil Steam Jet Agitators to increase pickling production at lower cost per ton. Violent agitation and proper heating of pickling solution in one simple operation will save valuable time and money, for you, too.**

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### 17 Ways of Increasing Heat Treating Efficiency With Submerged Electrode Salt Baths

**Seventeen** ways in which the submerged electrode salt bath furnace can increase metal heat treating efficiency on 10 specific heat treating applications in the temperature range from 1100°F to 2400°F are described in a new bulletin available from the **Ajax Electric Company, Inc.**, 930 Frankford Avenue, Philadelphia 23, Penna.

★ ★ ★

**Recently** introduced by Ajax, the submerged electrode furnaces are a logical addition to the line of suspended electrode furnaces pioneered by the firm, and widely used throughout the industry for a variety of heat treating applications.

★ ★ ★

**Copies** of the new Ajax Submerged Electrode Salt Bath Furnace Bulletin 123-B are available on request to the manufacturer.

★ ★ ★


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**DEPENDABLE EFFICIENT LOW COST SERVICE**

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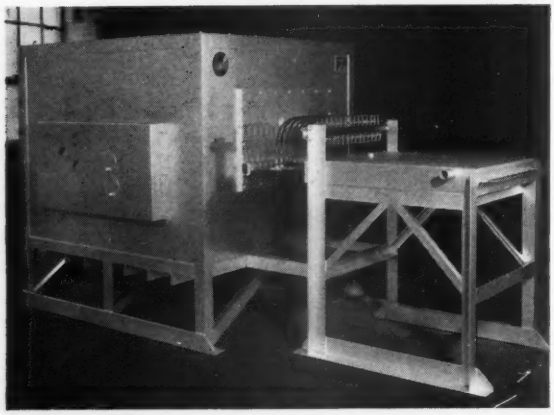
***your* HEAT TREATING OPERATIONS**



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### Painter To Head ASTM

**The American Society for Testing Materials**, through its President, **Harold L. Maxwell** (E. I. du Pont de Nemours and Co.) has announced the election of **Robert J. Painter** as Executive Secretary of the Society and of **Raymond E. Hess** as Associate Executive Secretary and Editor in Chief, both promotions effective September 16.

★ ★ ★

**This** action was taken by the Board of Directors following a report of a special committee which had been appointed to recommend a successor to the late C. L. Warwick, long-time Executive Secretary of the Society, who died suddenly April 23.

★ ★ ★

**Both** men have been members of the ASTM for many years. Mr. Hess has been Assistant Executive Secretary and Editor, and Mr. Painter most recently has been Treasurer and Assistant Secretary.

### Thompson of Anaconda Panelist At Society Meeting

**Harry E. Thompson**, director of research for **Anaconda Wire & Cable Co.**, Hastings, N. Y., will be a member of a discussion panel at the October 15th meeting of the Metropolitan Section of the American Society for Quality Control, to be held at the National Cash Register Auditorium in New York City. Subject of the panel is "Managing a Quality Control Program."

★ ★ ★

**Before** his recent advancement to the position of director of research at Anaconda, Mr. Thompson was himself manager of quality control. He has been succeeded in his old position, which encompassed all inspection and testing activities, by E. L. Gittleson.

### Metron Technical Data Sheet No. 48HJK

**In this** is described their line of high accuracy, portable tachometers for making speed measurements with precision and convenience otherwise unavailable in a small, portable, continuously indicating instrument. Inherent stability, ruggedness, and simple calibration insure sustained accuracy, even when operated under adverse conditions. For a copy, write to **Metron Instrument Co.**, 432 Lincoln St., Denver 9, Colo.

## Creep and Relaxation of High Strength Steel Wires at Room Temperature

(*Continued from page* 1061)

comparison between creep and relaxation so far completed, still it is of some interest to speculate on the reasons for the somewhat larger actual measured relaxation than is suggested by the creep data. In view of the apparent extreme decelleration effect that added strain exerts on relaxation or creep rate, the creep strain may be thought to be causing sufficient additional strain-hardening to make this difference.

### Summary and Conclusions

**In** these two high strength steel wires, creep or relaxation rates are so high initially that most of the plastic strain that is to take place occurs as the wire is loaded. Moreover, these initial rates are so great that nominal stress strain properties, shown by the usual stress-strain curve, remain unaffected by relatively large changes in rate of strain, at least up to some 80 per cent of tensile strength. When a particular level of load or strain is reached and maintained, creep or relaxation rates rapidly diminish and the curves tend to approach levels which are higher the higher the stress.

★ ★ ★

**This** large dependence of rate of creep or relaxation on strain affords an important means of increasing load-carrying stability of these wires in the cold drawn state. This method involves straining or "stretching" the wire as far beyond the final working level as is feasible.

★ ★ ★

**Another** important treatment which may be applied to the cold drawn wire to improve its properties in this respect is stress-relief heat-treatment. Such an operation, so conducted that wire ductility is not inordinately increased and also in such a manner that the final product is reasonably straight, results in a wire which is excellent for prestressing purposes. Up to some 50 per cent of the tensile strength the wire is free of creep, and in addition, its straightness is of great advantage in ease of handling for the prestresser, particu-

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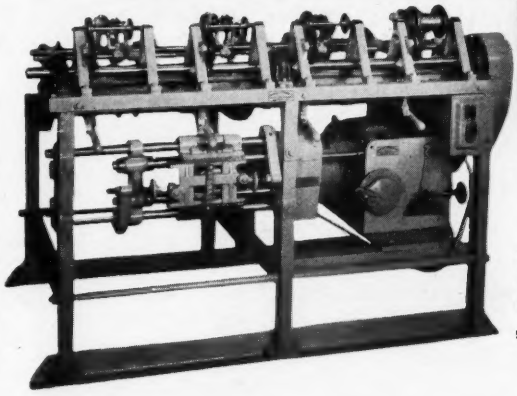

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Capacity: Usually 4 to 10 spindles

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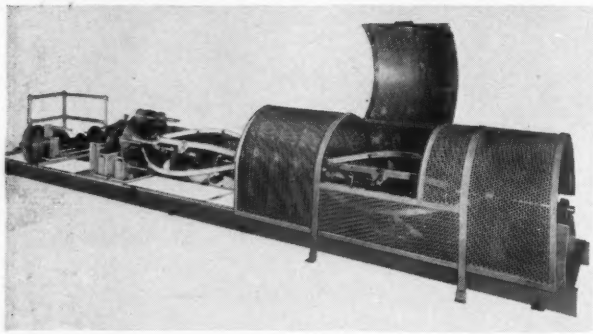
# EDMANDSCO WIRE TWISTING MACHINES



Illustrated on the left is the THREE WIRE TWISTER with Filling and Serving Attachments.

This is a high speed, light duty machine, for a wide range of twisted, filled and served cords of various types.

EDMANDSCO Wire Twisting Machines are made in three types for twisting 2, 3 and 4 wires; any of the sizes can be equipped with filling and serving attachments. In the 4-wire type, filling, serving and taping attachments can be added.

The speed and production of all EDMANDSCO machines are high. Depending on the type of wire to be twisted and the size of the machine, the speeds will vary from 1140 r.p.m. downwards.

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larly in the larger wires.

★ ★ ★

**In** this prestressing application, where creep and relaxation must be limited, it appears that we must also limit ductility rather than strive to maximize it. The amount of creep appears to be definitely related to the uniform or "available" elongation, which corroborates the evidence of the creep curves as to the large effect of strain on the rate of creep or relaxation.

★ ★ ★

### Elgin Announces New Booklet on Diamond Finishing

**The** Abrasives Division of the **Elgin National Watch Company**, Elgin, Illinois, has announced the availability of a new 8 page booklet on the efficient application of diamond abrasives. The new booklet contains basic information on the characteristics of diamond as an abrasive together with complete catalog data on Elgin Diamond Abrasive, DYMO, and the DYMO Finishing accessory line.

★ ★ ★

**Outstanding** feature of the booklet is actual illustration and detailed explanation of the primary applications of diamond for finishing—drawing die polishing, plastic mold finishing, cutting tool edge finishing and mass-production polishing of component parts.

★ ★ ★

**For** further information, address inquiry to Abrasives Division, Elgin National Watch Company, Elgin, Illinois.

## Can Quality Control Be Used in the New Mill?

(*Continued from page* 1063)

be decided upon and clearly defined.

★ ★ ★

**The** Quality Control supervisor would want to know if the off-gauge wire was confined to specific pieces of equipment or specific operators. To determine this, he would have the wire foreman see that coils or spools were individually tagged. He would see that the chief inspector understood the reason for the tagging and see that he transferred the necessary information to the test sheets. He might also request additional inspection, such as the minimum and maximum diameter of each end of each spool or coil.

★ ★ ★

**The** inspection reports for a short period would then be analyzed to see if any one operator or any specific piece of equipment produced or tended to produce off-gauge wire. It is quite likely that all the wire would be within tolerance at first as the operators would know that their work was being checked more closely. However, tendencies toward the minimum and maximum diameter might be noted, or it might be necessary to continue the tagging and analyze the results for a longer period.

★ ★ ★

**The** wire drawing operation itself, along with the related operations of cleaning, coating and die making, would be studied by the Quality Control Department. Habitual or occasional operational practices, or equipment defects that might contribute to the production of off-gauge wire would be noted. These would then be discussed with the supervisors involved, and corrective action taken when it seemed advisable. The Quality Control Department would keep a record of all changes made and note if they had any bearing on the final results. When it appeared that any definite factor was the cause or a contributing cause to the off-gauge wire, it would then be discussed with the

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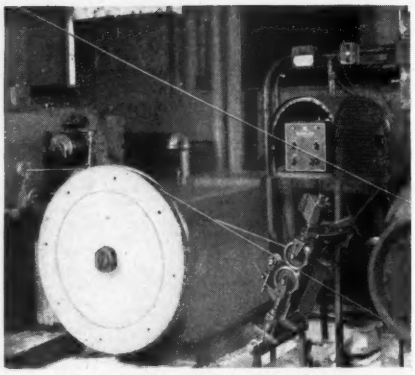

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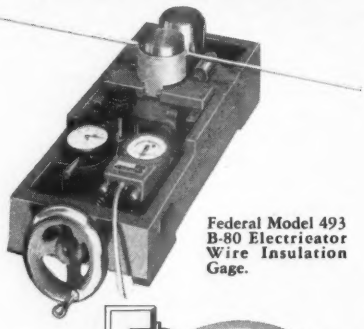
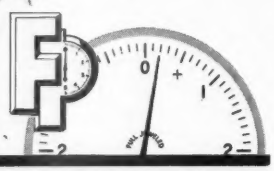


Federal Model 493 B-80 Electricator Wire Insulation Gage.



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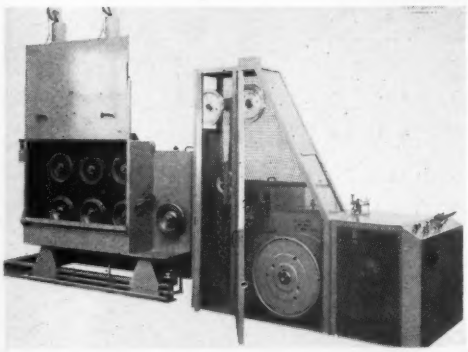
# INTERMEDIATE WIRE DRAWING MACHINE FOR NON-FERROUS WIRE



Finish Speed 4000 and 5000 F.P.M.
13 Die—Enter B & S No. 8
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Picture at left shows Cook Intermediate Wire Drawing machine with Take-up Equipment.

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head of the department involved. He would either verify that conditions had remained the same or if they had not, he would point out the changes that were intentionally or unintentionally made. The Quality Control Department would set up some means of detecting off-gauge wire at the drawing equipment if this seemed advisable, or would arrange to have the Testing Department report to the Operating Department as soon as wire diameters reached or approached tolerance limits.

★ ★ ★

**At** the end of the investigation, the Quality Control Department would make a report of its findings and its recommendations for preventing or minimizing the production of off-gauge wire and its subsequent shipment. The Works Manager would then authorize any changes that might require his sanction and would instruct the various department heads to make changes as outlined in the report unless some better way was advanced.

★ ★ ★

**The** Quality Control principle is no doubt being followed on certain types of problems in all wire mills. Every worker, foreman, superintendent, metallurgist, and engineer is responsible for quality and its control within certain confines. The introduction of modern Quality Control within a mill does not diminish their responsibilities for quality but coordinates them and increases them. Quality Control introduces into a plant a person or group of people whose sole responsibility is quality. In carrying out this responsibility they will ferret out facts and conditions which had not been given serious consideration heretofore. They will appraise these facts and conditions honestly and impartially and discuss them with operating men, development men, engineers, policy makers, and salesmen to arrive at a solution which will benefit all. Some concerns may feel that Quality Control is an unnecessary expense but Quality Control as I have tried to describe it will more than justify itself both directly and indirectly and increase profit dollars.

★ ★ ★

## Drawing of Weaving Wire

(*Continued from page* 1042)

it up in billowing clouds with a broom. Walls are painted a light pastel green of high light reflecting index. There are no more dark green dados to conceal dirty handmarks. Lighting has been stepped up to 35 foot candles at working level, which is about fifteen times the minimum enacted by a progressive Massachusetts legislature in 1922. Germicide lamps are installed in areas of congested occupancy to reduce contagion from colds. Transport is on inner cushion rubber tires, mostly on creosoted wood block flooring. Due to heavier loads and out of door storage, gasoline powered elevating trucks are replacing storage battery equipment that has given a generation of excellent service.

★ ★ ★

**Looking** to future progress, it would appear that faster wire drawing speeds may develop with improved cooling; but the conventional 16 inch block holds little promise of carrying heavier coils of fine wire at greater speeds without snarling, so that the introduction of larger diameter push up blocks, as well as the laying of wire onto dead head reels from horizontal drums as fast as it is drawn, may be next to compete in the obsoleting of our present equipment.

---


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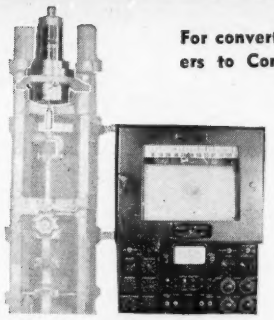

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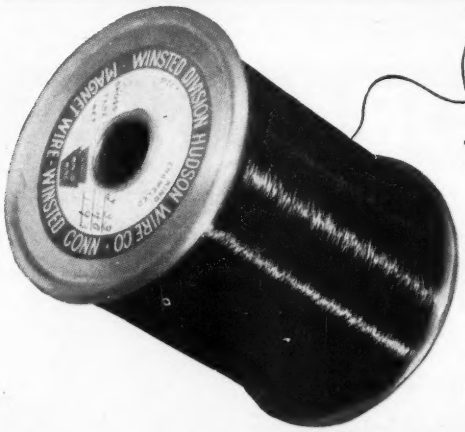


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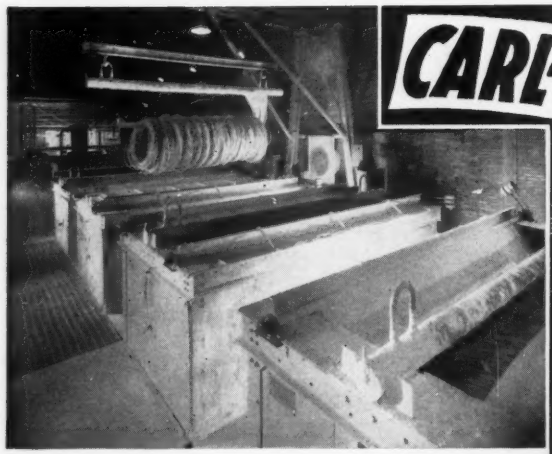

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## The Development of Improved Electrical Wiring Materials

(*Continued from page* 1040)

conductors affording the desired spacing.

★ ★ ★

**After** many experimental runs were made and tested it was found that in all respects the best plastic compound for the sheath was the same Type TW compound that had proven best for the primary insulation. This particular compound was the result of extensive development efforts to create a thermoplastic compound with a much wider useful temperature range than the 90 degree Centigrade (or 162 degree Fahrenheit) range that is typical of the popular commercial compounds.

★ ★ ★

**In cold** climates the cable may be handled at temperatures as low as 40 degrees below zero Fahrenheit without susceptibility to damage under such conditions. On the other hand the cable must be able to withstand without serious damage as much as 300 percent overloads for extended periods while under physical stress. The combination of a vastly improved thermoplastic compound with the Fiberglas reinforced construction achieved a thermoplastic cable construction able to withstand extreme operating temperatures from 40 degrees below zero to 250 degrees Fahrenheit above zero. This represents about a 75 percent extension of the previously practical temperature range.

★ ★ ★

**In designing** a thermoplastic cable of this type the features of cables made of Neoprene provided a yardstick to match and excel. Both of these general types of synthetic materials are highly resistant to mechanical abuse, wet conditions, flame, fungus and chemical attack. However, the superior electrical properties of the thermoplastic materials permit the use of thinner insulating walls and therefore smaller overall dimensions. Since a mechanical grade Neoprene must be used for overall sheaths, the use of an insulating grade Type TW thermoplastic sheath affords additional electrical as well as mechanical protection.

★ ★ ★

**Thermoplastics** can be made in any color or shade, which is not

practical with Neoprene. Consequently A-Z Cable is made with a white sheath as standard so it need not be painted in dairy barns. It can be made in any color for special applications. An indented or ink printing is applied to the outer surface of a thermoplastic sheath, thus providing positive identification as to number and size of conductors and type of cable.

★ ★ ★

**To select** a sufficiently unique trade-name for such an outstanding cable development, was no mean problem itself. It was soon discovered that in the insulated wire and cable field the possibilities among superlatives like Impervex, Resistol, etc., were already thoroughly exhausted. Trade mark experts pointed out that a trade mark which meant nothing, like "Kodak" and the famous "BX Cable" were the most successful. As a result "A-Z Cable" was the name chosen for the new plastic and glass Non-Metallic Sheathed Cable.

★ ★ ★

**Over** the several years during which they have been in service the improved cables known at first as Better Barn Cables have established themselves in a wide variety of applications. Based upon this experience Field Inspectors, Contractors, Utility Engineers, and Manufacturers have worked toward obtaining appropriate recognition in the Codes and Standards of the Industry. As a result the forthcoming 1953 revision of the National Electrical Code will identify such cables of appropriate construction as Type NMW and will permit their use in wet and corrosive locations. This represents the final phase of a development which is also very vital, namely recognition by the Code and other authorities in the field.

★ ★ ★

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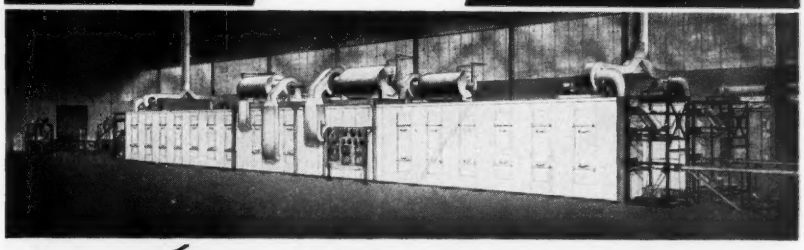

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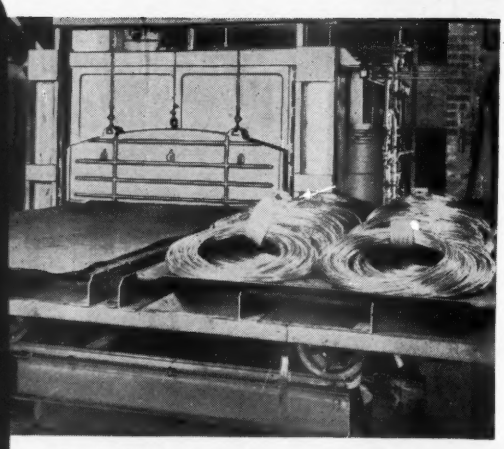

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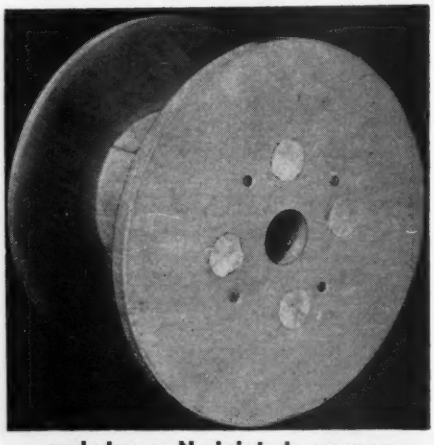

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## Weathering Characteristics of Polyvinyl Chloride Type Plastics

(*Continued from page* 1057)

### Summary

**Simulated** weathering tests were examined critically and correlation with actual weathering was found unsatisfactory for reliable use. The importance of placing suitable emphasis on volatility, low temperature flexibility and other long range properties in a plastic designed for a long weathering life was developed.

★ ★ ★

**The development** of polyvinylchloride plastic products to withstand weathering for extensive periods of time is quite feasible, but requires very careful selection of all components. Choice of plasticizers, stabilizers and protective pigment is particularly critical.

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## Selection and Processing of Chromium-Nickel Stainless Steels for Magnetic Applications

(*Continued from page* 1038)

properties. It is a well-known fact that the temperature at which these alloys are cold worked affects the rate at which they become magnetic. Generally, the higher the temperature, the more slowly they become magnetic. As a consequence, drawing speeds which determine the wire temperature are important. For similar reasons the amount of reduction per pass has an effect. Storchheim [4] has given some data on the effect of drawing speed on coercive force and residual induction. Some figures from his paper are listed in Table III. Figures 3 and 4 illustrate the influence of drawing speed and number of passes on magnetic permeability as determined in our own laboratories. Increasing the speed of drawing decreases the tendency of the wire to become

magnetic probably because of the increase in the temperature of the wire. Similarly, one large pass does not raise the magnetic permeability as much as the same reduction accomplished by several small ones.

★ ★ ★

## Conclusions

**The** selection of the best composition to achieve certain magnetic properties in chromium-nickel stainless wire is attended by many difficulties and much remains to be learned about this subject. It is clear, however, that composition alone is not the only important point and that proper regard must be given to processing, especially such factors as drawing speeds and temperatures.

★ ★ ★

**Since** this field is a comparatively new one, close cooperation is needed between the mills supplying wire for redrawing, the redrawers, and the final customer to achieve the best results. Purchasers of wire should recognize that a wide range of magnetic properties can be provided and, accordingly, should describe as accurately as they can just what properties they want and how they are to be measured. Statements such as "the wire must be non-magnetic" and requests for permeability values or other magnetic properties which fail to mention the desired testing conditions are not infrequent and plague the metallurgist, who must select the best alloy for the application. Similarly, the mill can do its best job only when it knows something of the processing methods which the redrawer plans to apply.

★ ★ ★


## Acknowledgment

**The authors are greatly indebted to the management of the Armco Steel Corporation and to the Rustless Division for permission to publish this paper.**


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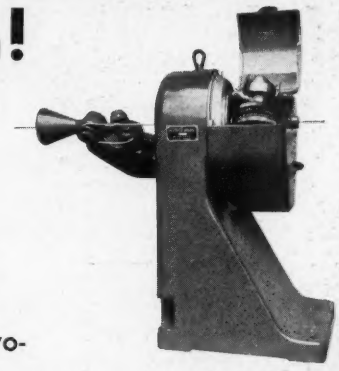

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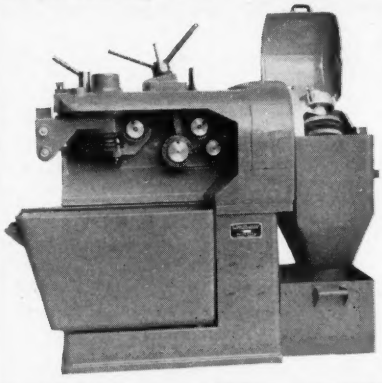

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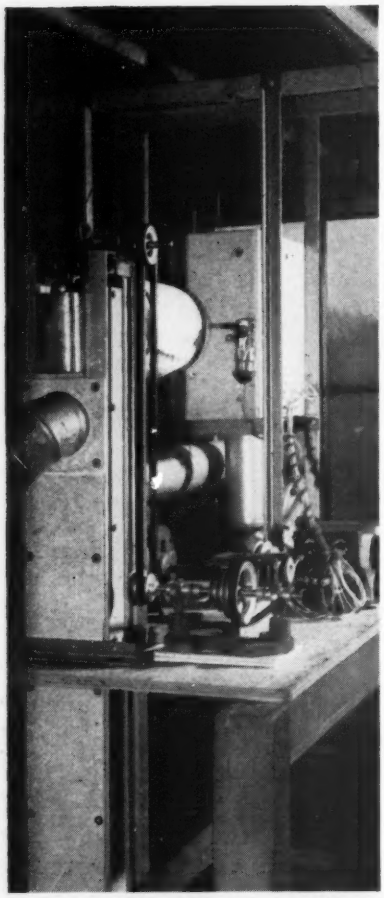

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## Effect of Certain Impurities on Free Cutting Brass

(*Continued from page* 1029)

**An examination** of these results showed the only major differences between the samples were in the aluminum and antimony contents. It was assumed therefore that the presence of one or both of these elements constituted one condition necessary to produce the blistering.

★ ★ ★

**Microscopic** examination of the blistered wire showed that the entire surface was cracked to a depth of three or four grains (Fig. 4). Bending of the rod resulted in general rupturing and flaking of the entire surface, leaving a rough granular surface. A nick and break test on the blistered rod showed a distinct ring of oxidized metal around the entire periphery (Fig. 5).

★ ★ ★

**The balance** of coil #3 above (not annealed) was used for further testing along with a coil which contained no aluminum or antimony. Mechanical tests made on the unsatisfactory coil included twist tests, tensile and twisting plus annealing in an electric furnace at 800°C. No indication of cracking, blistering or any unsoundness was detected in these tests nor did microscopic examination reveal any defects.

★ ★ ★

**Additional** annealing tests were made on short sections cut from both the good and bad coils as follows:

1. **Electric furnace—700°C. ½ hour**
2. **Electric furnace—835°C. 2 hours**
3. **Oil fired muffle—810°C. 1 hour**
4. **Sodium nitrate salt bath—575°C. 1 hour**

Again no indication of blistering or cracking, could be found on any of the samples through visual or microscopic examination.

★ ★ ★


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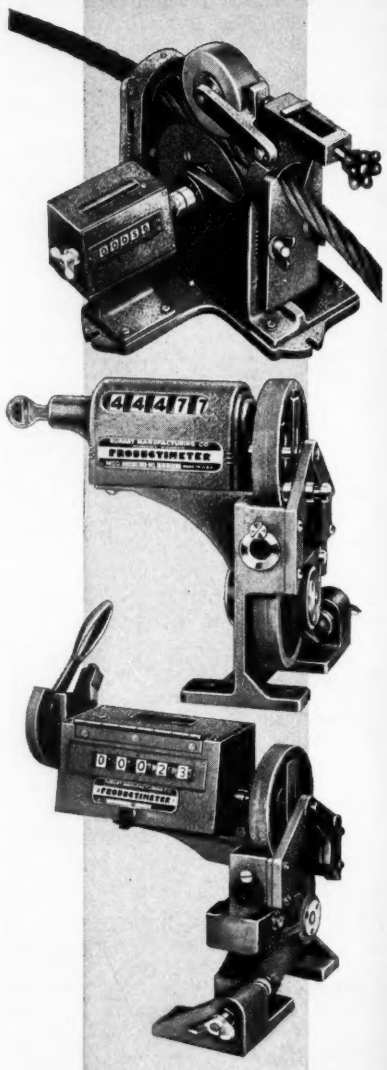

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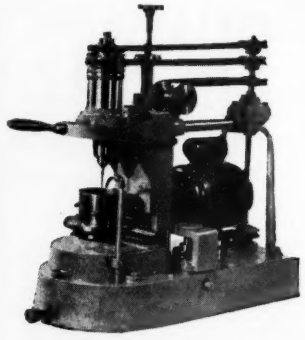

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**An annealing** series was then set up using the potassium carbonate, potassium chloride salt which produced the blistering originally. A salt pot approximately four inches deep was placed in an electric furnace maintained at constant temperature. Samples from the good and bad coils were immersed in the molten salt for approximately one-half their length giving the effect of a salt bath anneal and a normal atmosphere anneal on opposite ends of each sample. A series of nine anneals was run in this manner starting at a temperature of 680°C. and increasing in increments of 20°C. to a maximum temperature of 840°C.

★ ★ ★

**Visual** and microscopic examination of these samples showed that slight blistering first appeared on the samples containing aluminum at an annealing temperature of 740°C. and became progressively more severe as the temperature increased. It was also noted that no blistering occurred on that portion of the samples above the salt line nor did it occur at any place on the samples which did not contain aluminum. These results are shown in Figs. 6, 7, 8.

(See page 1025)

★ ★ ★

**One additional** set of samples containing 0.02% aluminum and 0.005% antimony was subjected to a series of salt bath anneals at temperatures ranging from 700°C. to 800°C. in an effort to establish a safe maximum for these elements. No blistering or cracking was encountered in any of these anneals so it was assumed that these percentages could be considered as safe limits. Since the antimony content of the samples was virtually the same as that present in some of the blistered coils, it was further assumed that antimony had little or no effect on the blistering.

★ ★ ★

**Results** of the experiments outlined above also led to the conclusion that three conditions were necessary to produce the blistering, namely:

1. **Presence of aluminum exceeding 0.02%.**
2. **Annealing in a salt bath.**
3. **Annealing temperatures approximating 740°C. or higher.**

★ ★ ★

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★ ★ ★

## ACSR Wire

(*Continued from page* 1026)

face, gauge and appearance. Sufficient physical tests are made to satisfy ourselves that the product will meet customer specification in every respect. The actual number of tests is in accordance with accepted standards of quality control. The tests performed are for tensile, stress at 1% elongation, weight of zinc coating, wraps, bends, and uniformity of zinc coating. Chart 6 lists the usual minimum requirements of these tests for some representative sizes of ACSR wire.

★ ★ ★

More specific details as to the physical requirements of each size is normally fully stated in customer specifications. The coating weight of the wire should always be heavier than the minimum requirements. The test for uniformity of coating—the Preece Test, and the bend test may or may not be listed in customer specifications. We make these tests in accordance with our quality control procedures, whether or not required by the customer specifications. The bundling depends on customer requirements. Usually three or four tie bands or steel straps are placed on each coil after each coil is individually weighted and properly tagged. Each coil is tagged with a durable tag showing the nominal size of wire, type of wire, weight of coil, purchaser's order number, and manufacturer's name. The starting end is also identified with a tag.

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★ ★ ★

**During** bundling and shipping every precaution should be exercised to deliver bright clean galvanized wire to the customer's plant. This is essential as any foreign material adhering to the surface of the wire may have very deleterious effects on the aluminum conductor wire. If the material is stored after bundling and prior to shipping, free use of paper should be made to protect the wire from the floor or racks. Also, the railroad cars or trucks used in shipment should be carefully inspected to be sure they have not been used to transport chemicals, especially alkalies, and are in prime condition.

★ ★ ★

**ACSR** wire is a high quality special galvanized steel wire "tailor made" to specific customer requirements to make a suitable and desirable product. Absolute control as outlined in the preceeding paragraphs must be and is exercised in all phases of production to meet this end.

★ ★ ★


**Grateful acknowledgement is given to the staff of the Detroit Steel Corporation for valuable help and advice in the preparation of this paper on "ACSR Wire".**


## Significance of the Elongation Test on Wire


(*Continued from Page* 1022)


not materially affect the percentage elongation in 10 inches because of the limited distance in which it takes place.

★ ★ ★

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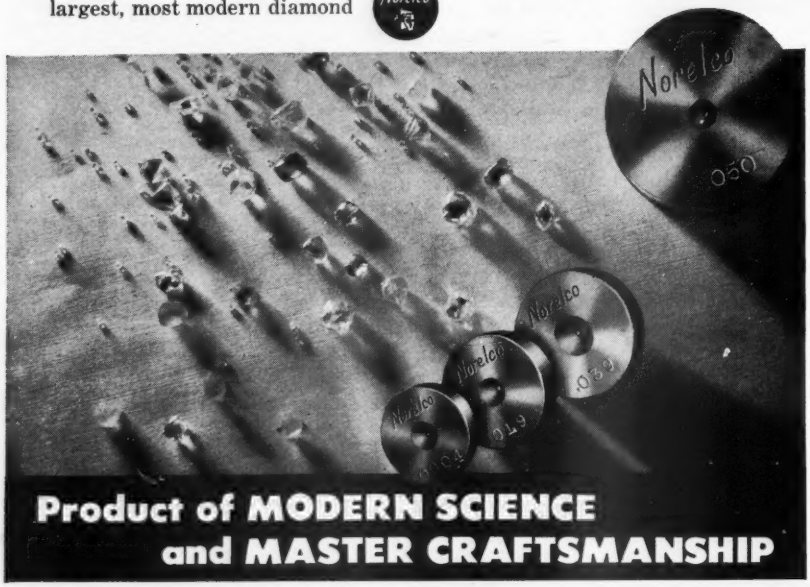


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uniform strain is probably caused by stress relief due to temperature. The internal stresses in as-drawn wire are of such a magnitude that the material reaches its necking stage earlier than it would if the internal stresses were not present. A comparison between wire as-drawn and wire mechanically stress-relieved is presented in Fig. 13. The stress-relieving was effected by bending the wire over a mandrel and substantiates the idea that the increase in uniform strain due to heating was a stress relief effect rather than a metallurgical effect. The mechanical stress relief increased the uniform strain without materially affecting the necking strain.

★ ★ ★

**The** decrease in necking strain due to temperature is probably the result of a strain aging effect.

★ ★ ★

**Adam*** has discussed the effect of heat treatment and galvanizing on the ductility of hard drawn wire, and has shown that similar results are obtained after heating in a lead bath as after hot galvanizing at the same temperature.

★ ★ ★

**The** results of additional experiments on the effect of temperature and hot galvanizing on hard drawn wire are presented in Table II.

**TABLE II**

**The Effect of Temperature and Hot Galvanizing on the Ductility of Hard Drawn Wire**

| | | As Drawn | Heated in Salt @ 850°F for 30 Sec. | Hot Galvanized |
|---|---|---|---|---|
| Diameter | in. | .1915 | .1915 | .1955 |
| Tensile Break | lbs. | 7,570 | 7,130 | 6,950 |
| U. T. S. | p.s.i. | 263,000 | 247,000 | 241,500* |
| Total Elong. in 10" | % | 2.5 | 6.4 | 7.3 |
| Reduction of Area | % | 40.2 | 37.5 | 34.2 |
| Bends on 10X Mandrel | | 44 | 30 | 31 |
| Ring Test | lbs. | 6650 | 3500 | 4450 |
| | | 6600 | 5300 | 3100 |
| | | 6600 | 5400 | 4250 |
| True Strain at Neck | % | 51.0 | 46.2 | 42.0 |
| Wrap Test on Own Diameter | | OK | OK | OK |

*Based on net diameter of wire.

The above comparisons indicate

*"Wire Drawing and The Cold Working of Steel", by A. T. Adam, p. 127-143, 1936, H. F. and G. Witherby.

that the loss in ductility in the hot galvanized wire was due primarily to the temperature effect rather than the zinc-iron alloy layer. The galvanizing itself, however, may affect the ductility of the wire to some extent. The above tests also show the inadequacy of the elongation in a 10 inch gage length as a measure of the relative ductility when the comparison is made on materials processed by different methods.

It is noted that although the ductility of the hard drawn wire decreased after heating and after hot galvanizing, the wire was still sufficiently ductile to be wrapped on its own diameter without fracture. Both the heated wire and the hot galvanized wire are therefore sufficiently ductile for many purposes.

## Conclusions

The elongation which takes place in the tensile test can be divided into two parts—uniform elongation and necking elongation. Uniform elongation takes place between zero load and maximum load. Necking elongation takes place between maximum load and the actual fracture load.

**The** necking elongation has been found to be a more reliable measure of ductility than the usual percentage elongation measurement in a 10 inch gage length, particularly where comparisons have been made on materials manufactured by different processes.

★ ★ ★

**The** generally accepted tests such as the torsion, bend and wrap tests have usually been found to be reliable indices of ductility and correlate with the necking elongation.

★ ★ ★

**When** comparative tests are made on wires which have been manufactured in the same manner the percentage elongation in a 10 inch gage length can be of considerable significance.

★ ★ ★

**When** the elongation test is included in a specification its limitations should be fully realized and the specified values should be compatible with those normally obtained on the type and size of material in question.

★ ★ ★


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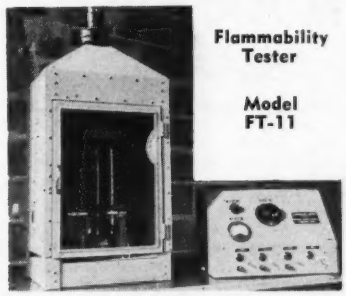

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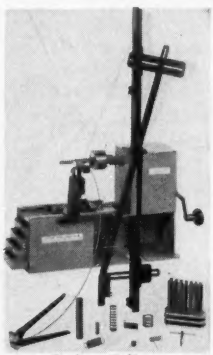

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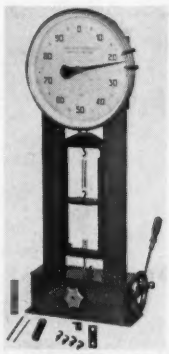

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### Announce World's First Machine for High Production, Low Cost External Thread Rolling on Hollow Work

**An** unprecedented 19,440 pieces-per-hour is the rate at which external, class 3 fit threads are rolled in 1/2"-13 hollow set screws of S.A.E. 1035 steel on the new Model 300 Prutton "Rollmaster", introduced by **D. H. Prutton Machinery Co.**, 5295 W. 130th St., Cleveland, Ohio.

★ ★ ★

**Extremely** versatile, the machine is said to perform comparably on either hollow or solid work in a wide variety of metals ranging from non ferrous, through aluminum and magnesium, to hardened and stainless steels.

★ ★ ★

**According** to D. H. Prutton, company president, the efficient "planetary die" principle, an exclusive Prutton development, radically reduces thread rolling pressure by distributing it evenly over a full 30 inches of die "length". Thus the danger of distorting or crushing hollow parts due to excessive pressure from "shorter" dies is eliminated.

★ ★ ★

**Pieces** are hopper-fed, and "roll" at close intervals around the circumference of the die. The large numbers of pieces in work at a time make possible slower die speeds, less wear and a proportionate extension of die life.

★ ★ ★

**"While** producing at speeds many times that of conventional thread cutting and grinding on hollow work," Prutton stated, "rolled threads offer the known better quality of finer grained thread structure and the accuracy of a class 3 fit."

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**The** company is designer and manufacturer of the Prutton "Rollmaster" in other models for many applications of high-production, low-cost thread rolling, and the Prutton "Tapmaster", a 3-spindle, fast production tapping machine also available in several models. Complete details on request.


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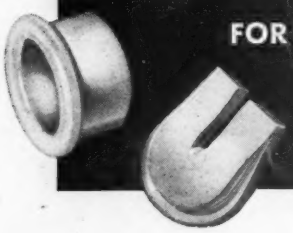

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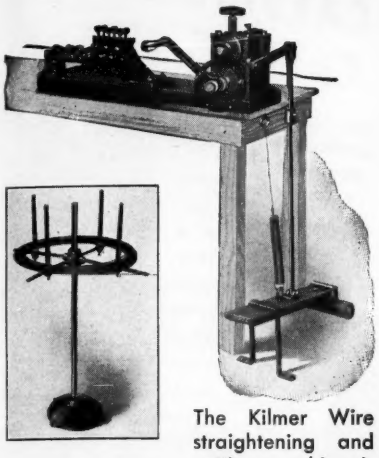

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## Anaconda Publishes New Catalog

**The Anaconda Wire & Cable Company** has just published a new catalog on POTHEADS & TERMINALS which comprises Section #13 of their GENERAL CATALOG.

★ ★ ★

**The** new catalog (No. C79-13) includes complete design data as well as information and instructions valuable for proper ordering and installing all types up to 46 KV. It features both outdoor and indoor types and popular designs for transformers and switchgear.

★ ★ ★

**It** clearly illustrates such desirable features as simplicity, interchangeability and reliability.

★ ★ ★

**This** new publication, as an individual catalog, or the General Catalog incorporating Section #13, is available by addressing a letterhead to E. F. Luna, Sales Promotion Director, Anaconda Wire & Cable Co., 25 Broadway, New York 4, New York.

## "Corrosion Testing Procedures"

**This** new book by **F. A. Champion, Ph.D., A.R.C.S., F.I.M.,** came from the press on July 1st. It is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y., runs 376 pages in length and sells for $6.25.

★ ★ ★

**It is** designed primarily for the investigator concerned with the practical problems of the corrosion of metals in service and the production of metals of adequate corrosion resistance.

★ ★ ★

**In view** of the wide variety in the objectives of corrosion, the course followed by the author has been to divide the text into the following stages and then describe the various procedures for each stage:

1. **Choice and preparation of metal and corrosive.**
2. **Exposure of the metal under conditions selected for the test—laboratory, field or service.**
3. **Cleaning of specimens preparatory to examination.**
4. **Examination for the effects of corrosion.**
5. **Interpretation of the results and the expression thereof.**

★ ★ ★

**The** book is liberally illustrated and contains many formulae and tables and will be found to be literally a handbook of corrosion testing procedures.

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### New Nut Speeds Assemblies

**A new** floating anchor nut developed by the **Elastic Stop Nut Corp. of America**, Union, N. J., is said to be cutting assembly time and costs in the manufacture of aircraft components.

★ ★ ★

**The** nut is self aligning, saves weight, and eliminates costly lining-up operations. Savings up to 3 and 4 cents per unit are being made. The special feature of this nut, called their "A-41", is an offset shoulder on the anchor lug, which provides full floating action of the nut by eliminating interference between it and the two rivets that hold the lug to a part of the assembly. The new nut is also provided with a fiber or nylon locking collar that gives the nut a firm grip on the bolt that will hold under both impact and vibration. The smaller size of the new nut makes it possible to use it in many places where larger nuts cannot be employed.

### Made in the U. S. A.—By Big Business and Small Business

**Westinghouse Electric Corporation** has compiled a chart showing what happens when it gets a Government defense contract. It shows that for electronic equipment they subcontract to large and small firms alike, with 44% of their dollar orders going to subcontractors. Of the total of 635 firms to whom this work is given, 128 are large concerns and 507 in the small business category—that is, 80% of the work let out goes to small business.

★ ★ ★

**Westinghouse** has a total of 14,-107 subcontractors for all kinds of work on its books, with more being added constantly. These are located in every part of the country. It is a policy of this kind that directly or indirectly affects the well-being of America's 60,000,000 workers in industry.

### Develops New Type of Fastener

**The Delron Company, Inc.**, manufacturer of specialized fastening devices, announce a unique, practical, new fastener. This new product, the fasco spacer, is a strong, lightweight bolt type spacer, designed to solve critical fastening problems where

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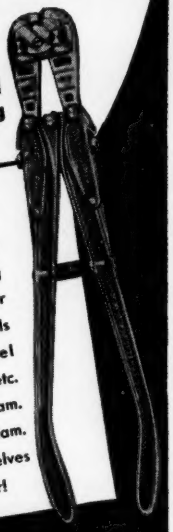

Stand up under the hardest usage. Tough carbide edges firmly brazed to cutting jaws. Excellent for extra hard materials like stainless steel rods, wires, pins, etc. #3 cuts to 5/16" diam. #4 cuts to ⅜" diam. Pay for themselves many times over!

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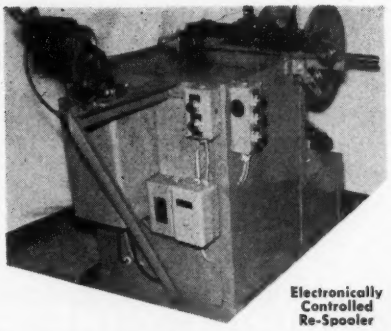

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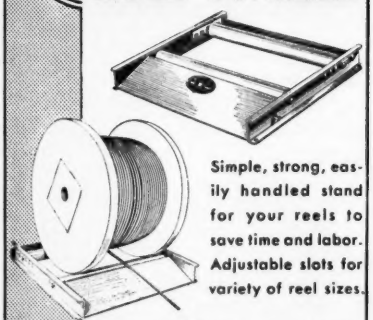

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**Other** important applications include soft woods such as balsa, and any fragile structure where the take-up of nut and bolt must be limited to a specified grip length.

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**The** spacer can be installed by hand with ordinary nut and bolt, but for faster production installations, a squeezer die with index pin can be used.

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**Further** information may be obtained from Delron Company, Incorporated, 5524 Southern Avenue, South Gate, California.

### Announces New Rigid Plastic Line of Pipe, Tanks and Ducts

**As** a result of a three year intensive research and development program, **Atlas Mineral Products Company** announces the commercial availability of its Ampcoflex rigid plastic line. A sales development program has been carried on during the past year in the Philadelphia area by the Coward-Eastman Company, who will have an exclusive representation on Ampcoflex fabricated structures in that area. Distribution plans for hemisphere-wide distribution through other outlets are now under development.

★ ★ ★

**Ampcoflex** is a rigid plastic material available as extruded pipe with molded fittings, formed containers and fabricated tanks, as well as square and round duct sections in standard sizes. Non-standard units can also be designed, engineered and fabricated at the Mertztown plant in Pennsylvania.

★ ★ ★

**Descriptive** and technical information on Ampcoflex are available.

### Rototrol Rotating Regulator in Steel Industry Booklet Available from Westinghouse

**A revised** 22-page application booklet on Rototrol rotating regulators for the steel industry is available from the **Westinghouse Electric Corporation.**

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**This** edition presents up-to-date information on the Rototrol's functions, applications, and accomplishments as a control for steel producing and processing equipment. Fourteen different steel mill applications of Rototrol are described with circuit diagrams, photographs, and sketches. The application of Rototrols as speed regulators for skip hoist drives, as tension controllers for winding and unwinding operations, and as power regulators for arc furnaces are typical. Case-history information is provided for each application. Finally, a 4-page section presents the principle of operation of the Rototrol.

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**For** a copy of this booklet, B-3998-B, write Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pennsylvania.

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**Phosnic bronze,** a high-copper alloy containing nickel and phosphorus that makes it particularly well suited for manufacture of springs, clips, high strength electrical conductors, bolts, nails, screws, cotter pins and many parts where the combination of high strength, high electrical or thermal conductivity, high resistance to fatigue and creep and good workability are required, is being supplied by the **Chase Brass & Copper Company, Incorporated,** Waterbury 20, Conn., a subsidiary of Kennecott Copper Corporation. Phosnic bronze is a Chase patented alloy.

★ ★ ★

**In this** "age hardening" alloy an aging treatment determines its properties and increases its tensile strength from about 38,000 psi to about 65,000 psi while yield strength is increased from approximately 10,000 psi to 40,000 psi. After age hardening, the phosnic bronze, unlike some age hardening alloys in the heat treated condition, is suitable for severe cold working of any type. The wire can be drawn to full spring temper.

★ ★ ★

**Age-hardened** and cold drawn phosnic bronze has greater creep strength than other alloys in comparable tempers including cartridge brass, phosphor bronze or high-silicon bronze. This property makes it particularly well suited for bolt and structural material, where high resistance to creep or flow under the influence of prolonged stress is desirable.

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**The** high strength of phosnic bronze is due to the combined hardening effects of controlled age-hardening heat treatment and cold working by drawing or rolling. It is supplied as age-hardened only, or as age-hardened and cold worked in a range of tempers up to special spring temper.

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**Available** round wire forms range in diameter from 0.016″ to 0.650″; wire, rolled flat, 0.093″ x 0.012″ to 1.00″ x 0.125″; round rod in diameters from 1/16″ to 1¾″; and hexagonal rod from 1/16″ to 1¼″ across flats.

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## Torrington Manufacturing Company Elects New President

**S. W. Farnsworth,** president of the **Torrington Mfg. Co.,** has announced the election of **Andrew Gagarin,** 37, to the presidency of the company effective Jan. 1, when Mr. Farnsworth will become chairman of the board. In the announcement, Mr. Farnsworth said he will continue to devote his full time to daily problems of the business.

★ ★ ★

**Mr. Gagarin** is currently vice president of the company. He joined the organization in July, 1946, as a member of the production control department, and served, as assistant to the vice president in charge of manufacturing, and assistant to the president, before becoming vice president in March, 1950.

★ ★ ★

**Prior** to joining the Torrington Manufacturing Co.—world's largest manufacturer of fan blades, blower wheels, and spring making machinery, and builders of auxiliary mill equipment—he was associated with the Morgan Stanley Co., investment bankers in New York City.

★ ★ ★

**Mr. Gagarin** was graduated from Yale University in 1937. During World War II, he served as a line officer of the U. S. Navy in the Caribbean and the Aleutians. He completed four years of active duty in 1945, with the rank of Lt. Commander.

## Specifications for Copper and Copper-Alloy Welding Rods

**The latest** specifications for filler metal, issued jointly by the American Welding Society and American Society for Testing Materials (AWS Designation A5.7; ASTM Designation B 259) covers copper and copper-alloy welding rods for use with oxy-acetylene, carbon arc and inert-gas metal-arc (nonconsumable electrode) welding.

★ ★ ★

**The twelve** classifications established by these specifications include copper, silicon bronze, phosphor bronze, copper-nickel, naval brass, manganese bronze, low-fuming bronze, nickel bronze and aluminum bronze welding rods.

★ ★ ★

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**As with** the other filler metal specifications for copper-alloy electrodes and for steel and aluminum filler metal, these new specifications specify the chemical composition, mechanical properties and usability characteristics of each classification, with corresponding tests for verifying these properties.

★ ★ ★

**An** appendix is included as an aid to users in selecting the best welding rod for their needs and using it in the most efficient way.

★ ★ ★

**Copies** of the Specifications for Copper and Copper-Alloy Welding Rods can be obtained at 40 cents each from either **American Welding Society,** 33 West 39th Street, New York 18, N. Y., or **American Society for Testing Materials,** 1916 Race Street, Philadelphia 3, Pa.

★ ★ ★

## Silicone Rubber: A New Insulating Material for Wire and Cable

(*Continued from page* 1073)

tension requirements. Ignition systems must be shielded to prevent radio interference. The excellent electrical properties of silicone rubber allow the cable to deliver the required voltage to the plugs despite the high opportunity for leakage caused by the shielding.

### (c) Other Applications

**Navy** and ignition cable represent the two largest volume uses for silicone rubber in the wire industry. However, other constructions have been devised to take advantage of one or more of the outstanding features of silicones:

1. **Thermal stability**
2. **Ozone resistance**
3. **Chemical inertness**
4. **Electrical Stability**
5. **Ashing characteristics**
6. **Weathering resistance**
7. **Aging resistance**
8. **Non-toxicity**

Silicone rubber is being used as insulation for motor and transformer lead wires, thermostat wiring, radio frequency cables, and other constructions.

### The Future

**Looking** backward, we are impressed by the rapid strides made in silicone rubber technology during the few years this new elastomer has been in existence.

★ ★ ★

**Looking** forward, we realize we have scratched only the surface in determining the potentialities of this new material. The past achievements have been largely attributable to the concerns producing silicone products. These concerns are ever on the search for new polymers, new fillers, new techniques for improving silicones. Rubber compounds with improved physical and electrical properties are bound to be developed. Temperature limits will be extended.

★ ★ ★

**In addition,** many fabricators are now working with silicone rubber. Their efforts are not limited to the standard formulations which the suppliers have made available. The base silicone gum is being marketed. Engineers and compounders in laboratories throughout the rubber industry are working to develop new and better products. Their vast knowledge of the rubber art is bound to accelerate the development of new and better silicone compounds.

★ ★ ★

**With** improvements in compounds, with more experience and consequent greater confidence on the part of fabricators and end-users, applications will become increasingly more widespread. Silicones possess properties which no known organic elastomer can offer. End-users will want the advantages of these properties.

★ ★ ★

**Yesterday,** a laboratory curiosity! Today, a specialty insulation! Tomorrow, conventional insulation in cable constructions where the customer desires a quality product with the ultimate in temperature resistance, long life and performance properties!

★ ★ ★

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# Index to Advertisers


A

Ace Abrasive Laboratories ..... 1119
Acrometal Products Inc. ..... 974
Aetna-Standard Eng'g Co., The, Hale and Kullgren Div. ..... 943
Ajax Electric Co., Inc. ..... 947
Ajax Industrial Supplies, Inc. ..... 1139
Ajax Manufacturing Co., The ..... 990
American Brass Company, The ..... 945
American Chemical Paint Company ..... 975 and 1085
American Insulating Machinery Company ..... 956 and 957
American Woodworking Co. ..... 1140
Anchor Wire Corp. ..... 1124
Angier Corporation, The ..... 1083
Apco Mossberg Company ..... 980
Apex Alkali Products Co. ..... 1050 and 1051
Arkell Safety Bag Corp. ..... 1101
Artos Engineering Co. ..... 1079

B

Baird Machine Co., The ..... 983
Balloffet-Vianney Wire Die Co., Inc. ..... 1139
Bethlehem Steel Company ..... 942
Bick, Hans C., Inc. ..... 1142
Boulin, Victor J., Inc. ..... 1139
Boyd & Sons Mfg. Corp. ..... 1093
Bridge Mfg. Co. ..... 953

C

Carboloy Dept. of General Electric Co. ..... 1044 and 1045
Carl-Mayer Corp., The ..... 1124 and 1125
Carlson Company, The ..... 1133
Carris Reels, Inc. ..... 1133
Catalytic Combustion Corp. ..... 1116
Chase Brass & Copper ..... 949
Cedar-West Tool Co., Inc. ..... 961
Ceilcote Company, The ..... 1140
Chemsteel Construction Co., Inc. ..... 1140
Clarke, J. L. Mfg. Co., The ..... 1091
Cleveland Tramrail Division of the Cleveland Crane & Engineering Co. ..... 999
Cochaud Wire Die Corp. ..... 1139
Continental Steel Corporation ..... 981
Cook Mfg. Co. ..... 1122

D

Danforth Co., C. W. ..... 1141
Davis Electric Co. ..... 962 and 963
Durant Mfg. Co. ..... 1123
Durkee Mfg. Co. ..... 1133
Dykrex Corporation of America—Roos Tool & Mfg. Div. ..... 1129

E

Eastern Carbide Corp. ..... 954
Edmands Company, The ..... 1120
Eisler Engineering Co., Inc. ..... 1141
Electric Furnace Company ..... Back Cover
Electronic Rubber Corp. ..... 1120
Elgin National Watch Co., Abrasives Div. ..... 951
Emory, Robert J. Company ..... 1119
Engis Equipment Co., Hyprez Div. ..... 959
Entwistle, James L., Co. ..... 1008 thru 1014 and 1111
Erie Iron & Supply Corp. ..... 1140

F

Fatigue of Materials Laboratory ..... 1142
Federal Mfg. Co. ..... 1112
Federal Products Corp. ..... 1122
Fenn Manufacturing Co., The ..... 997
Fidelity Machine Co., Inc. ..... 1076
Firth Sterling, Inc. ..... 972
Fisher Associates ..... 1127
Fiske Brothers Refining Co. ..... 1108
Fitz Waterwheel Co. ..... 1135
Fort Wayne Wire Die, Inc. ..... 1139

G

Gerber J. & Co., Inc. ..... 1130
Glader, Wm. Machine Works ..... 1030
Glader, Wm. Machine Works—Export Department ..... 1089
Glass Fibers, Inc. ..... 948

H

Hale and Kullgren Div.—Aetna-Standard Eng'g Co., The ..... 943
Hamelin Lumber & Woodwork Ltd., J., The ..... 1031
Harling, J. G., Co. ..... 1140
Harper Electric Furnace Co., The ..... 1118
Haskell-Dawes Machine Co., Inc. ..... 1129
Haveg Corporation ..... 1113
Heany Industrial Ceramic Corp. ..... 1134
Heil Process Equipment Corp. ..... 1117
Heineman Corp., Oscar ..... 1137
Hercules Filter Corp. ..... 1003
Holden, A. F. & Co. ..... 988 and 989
Hoosier Wire Die, Inc ..... 1139
Howsam Spool Company ..... 966
Hubbard Spool Company ..... 1098
Hudson Wire Company ..... 1123
Hughesville Machine & Tool Company ..... 1090

I

Imhoff, Wallace G., Co. ..... 1142
Indiana Wire Die Company ..... 1138
Industrial Diamond Powders, Inc. ..... 1140
Industrial Gauges, Inc. ..... 1097
Industrial Ovens, Inc. ..... 1140
Interlocking Fence Company ..... 1090
International Paper Company, Container Division ..... 960
Ironsides Company ..... 1121

J

Johnson Steel & Wire Co., Inc. ..... 1084

K

Kelly Wire Die Corporation ..... 1139
Kenmore Metals Corp. ..... 1131
Kerns L. R., Company ..... 987
Keystone Steel & Wire Company ..... 1078
Kilmer, M. D. & Co. ..... 1134
Knight, Maurice A. ..... 1080

L

Laclede Steel Company ..... 1005
L & H Die & Tool Company, Inc. ..... 1134
Lancaster, Allwine & Rommel ..... 1142
Lewis, K. B. ..... 1142
Lewis Machine Company, The ..... 976
Libbey-Owens-Ford Glass Co., Fiber-Glass Division ..... 984

M

Magnus Chemical Co., Inc. ..... 1009
Magnuson Products Corp. ..... 1121
Malin & Company, The ..... 1134
Manco Manufacturing Co. ..... 1099
Manson Laboratories ..... 1133
Marshall-Richards Machine Co., Inc. ..... 971 and 998
Marshall-Richards Machine Co., Larmuth Division ..... 1002
Mason Can Company ..... 1135
McCaskie, Wm., Inc ..... 1135
Merrimac Paper Co., The ..... 1096
Metal Carbides Corporation ..... 952
Metal and Thermit Corporation ..... 1139
Mettler Machine Tool, Inc. ..... 978
Meyer, Roth & Pastor ..... 964
Micro Products Company ..... 1036A
Miller, R. H. Co., Inc. ..... 958
Milton Machine Works, Inc. ..... 1087
Modern Plastic Machinery Corp. ..... 1088
Montgomery Co., The ..... 982
Morgan Construction Company ..... 972 A and B
Morgardshammars Mek. Verkstads AB ..... 1001
Morrison Industries Inc. ..... 968
Mossberg Presssed Steel Corp. ..... 969

N

National Machinery Exchange ..... 1141
National Research Co. ..... 1136
National Rubber Machinery Co. ..... 1105
Nelson Company, The ..... 1140
New England Butt Company ..... 1100
Newbury Co., The ..... 1141
New England Lacquer Co. ..... 1128
New England Wire Die Co. ..... 1139
Niles Steel Products Div., Republic Steel Corp. ..... 986
Nilson, A. H. Machine Co., The ..... 1115
Nopco Chemical Co. ..... 1102
North American Philips Corp. ..... 1132
North Anson Reel Co. ..... 993
North Waterford Spool Co. ..... 1136
Norton Co., The ..... 1125

P

Pacific Coast Borax Company ..... 1131
Parkin Chemical Co., Inc. ..... 1107
Pittsburgh Cut Wire Company ..... 1136
Pittsburgh Steel Company ..... 965
Platt Brothers & Co., The ..... 1140
Porter H. K., Inc. ..... 1136
Pourtier Freres, Ets. ..... 1106

R

Ransohoff, Inc., N. ..... 946
Rayaloy Carbide Corp. ..... 1134
Reeves Pulley Co. ..... 953
Reilly-Whiteman—Walton Company ..... 1112
Rockwell, W. S., Co. ..... 1126
Roebling's John A. Sons Company ..... 979
Roll-A-Reel ..... 1137
Root, B. M. Co. ..... 1092
Royle, John & Sons ..... 970
Rusch Wire Die Corporation ..... 1139
Russ Electric Furnace Corp. ..... 1109

S

Scott Testers, Inc. ..... 1123
Scudder, E. J. Foundry & Machine Co., Inc. ..... 1140
Seneca Wire & Manufacturing Co. ..... 1081
Sjogren Tool and Machine Co., Inc. ..... Inside Front Cover
Sleeper & Hartley, Inc. ..... 1140
Solar Compounds Corporation ..... 1077
Solomon, Michael ..... 1141
Spencer Wire Corporation ..... 1127
Stanat Manufacturing Co. ..... 992
Standard Industrial Compounds Co. Inc. ..... 977
Standard Machinery Co., The ..... 991
Standard Mill Supply Co. ..... 1094
Steel Equipment Co. ..... 1075
Superior Tool & Mfg'g Co. ..... 1138
Surface Combustion Corp. ..... 985
Swift & Company ..... 1103
Syncro Machine Company ..... 994 and 995

T

Techema Company ..... 1137
Terkelsen Machine Co. ..... 1140
Torrington Mfg. Co. ..... 1086
Trauwood Engineering Co., The ..... 1004
Trembicki Company, The ..... 955

U

Union Wire Die Corp. ..... 996

V

Vascoloy-Ramet Corporation ..... 1006
Vaughn Machinery Company ..... Front Cover and 1052 A, B, C and D

W

Wafios Maschinenfabrik ..... 1106
Wardwell Braiding Machine Co. ..... 1082
Warner Company ..... 1138
Wartenweiler, Emilio ..... 1110
Waterbury Farrel Foundry & Machine Co. ..... 944 and 1036D
Watson Machine Company ..... Inside Back Cover
Wayne Wire Die Co. ..... 1138
Wean Equipment Corporation ..... 1036 B and C
Wells, Frank L. Co. ..... 1095
Westinghouse Electric Corp.,
Industrial Heating Works ..... 1034 and 1035
Wickwire Brothers, Inc. ..... 1138
Wilson, Lee Engineering Co., Inc. ..... 941
Winchester Reel Co., Inc. ..... 1126
Wire & Textile Machinery, Inc. ..... 1133
Wire Corporation ..... 1104
Wire Insulating Mach'y Corp. ..... 1137

Y

Youngstown Sheet & Tube Company, The ..... 967
Youngstown Welding & Engineering Co. ..... 973

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**CRANES—Wire Mill**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**CUTTING TOOLS—Carbide**
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

**CUTTING TOOLS—Wire**
Manco Manufacturing Co., Bradley, Ill.
Porter, H. K. Inc., Somerville, Mass.

**DIAMONDS—Industrial**
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

**DIAMOND POWDERS—**
Ace Abrasive Laboratories, New York, N. Y.
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Division, Elgin, Ill.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, New Kensington, Pa.
National Research Company, St. Claire Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

**DIAMOND POWDER RECLAIMING—**
Boulin, Victor J., Inc., New York, N. Y.
Danforth, The C. W. Co., Youngstown, Ohio
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
National Research Co., St. Claire Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

**DIAMOND TOOLS—**
Carboloy Dept. of General Electric Co., Detroit Mich.
Diamond Tool Research Co., Inc., New York, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Wayne Wire Die Co., Hillside, N. J.

**DIES—Carbide, Tungsten & Tantalum**
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

**DIES—Cold Heading**
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Vascoloy-Ramet Corp., No. Chicago, Ill.

**DIES—Diamond**
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York, N.Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

**DIES—Extrusion**
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

**DIES—Eyelet**
Eastern Carbide Corp., New Rochelle, N. Y.
Kelly Wire Die Corp., New York, N. Y.

**DIES—Pointing**
Sjogren Tool and Machine Co., Auburn, Mass.

**DIES—Repairs & Re-Cutting**
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

**DIES—Special Shapes, Etc.**
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.

**DIES—Swaging**
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

**DIES—Tube Drawing**
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

**DRAW BENCHES—**
(See MACHINERY—Draw Benches)

**DRUMS & TRAVERSES—Flange Steel**
Entwistle, Jas. L. Co., Providence, R. I.
Niles Steel Products Division, Republic Steel Corporation, Niles, Ohio

**DRYING EQUIPMENT—**
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

# WHERE TO BUY, Continued

**For more complete information, consult the annual Wire and Wire Products Buyers' Guide.**

**ENGINEERS—Consulting**
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.
Wire Insulating and Rubber and Plastics Processing —Hale and Kullgren, Inc., Akron, Ohio
Wire Mill—Lewis, Kenneth B., Worcester, Mass.
Zinc—Imhoff, Wallace G., Co., No. Highlands, Calif.

**EYELETS—Brass or Zinc**
Platt Bros. & Co., The, Waterbury, Conn.

**FENCING & FENCES—Wire**
Interlocking Fence Co., Morton, Ill.

**FOAM PRODUCING COMPOUNDS—**
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

**FURNACES—Brazing**
Electric Furnace Co., Salem, Ohio
Harper Electric Furnace Corp., Buffalo, N. Y.
Rockwell, W. S. Co., Fairfield, Conn.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

**FURNACES—Galvanizing Equipment**
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

**FURNACES—Heat Treating**
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, Detroit, Mich.
Morrison Industries, Bedford, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**FURNACES—Lead Melting**
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

**FURNACES—Pot (oil, gas, electric)**
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

**FURNACES—Resistance Heating, Strand**
(See Annealing Machines)

**FURNACES—Salt Bath**
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F. Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

**GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)**

**GRINDERS—Roll**
Norton Co., The, Worcester, Mass.

**GUIDES—for Wire**
Heany Industrial Ceramic Corp., New Haven, Conn.

**HAMMERS—Swaging**
Sjogren Tool and Machine Co., Auburn, Mass.

**HOOKS—Pickling & Liming**
Heil Process Equipment Corp., Cleveland, Ohio
Youngstown Welding & Eng'g. Co., Youngstown, Ohio

**HOISTS—Electric Travelling**
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio

**IMPREGNATING MATERIALS—**
Solar Compounds Corporation, Linden, N. J.

**INHIBITORS—Pickling**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

**INSULATING MATERIALS—**
Electronic Rubber Co., Stamford, Conn.
Glass Fibers, Inc., Toledo, Ohio
Heineman Corp., Oscar, Chicago, Ill.
Merrimac Paper Co., New York, N. Y.
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

**INSULATING MATERIALS—Paper—For Electric Wire Cable.**
Merrimac Paper Co., New York, N. Y.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

**LACQUERING SYSTEMS — See MACHINERY—Lacquering Electric Wire**

**LACQUERS—For Electric Wire**
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.

**LAME—LAHN—**
Montgomery Co., The, Windsor Locks, Conn.

**LIME—**
Warner Co., Philadelphia and Bellefonte, Pa.

**LUBRICANTS — For Metal Cutting, Stamping and Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

**LUBRICANTS—Wire Drawing**
(See Compounds—Wire Drawing)

**LUBRICANTS—Wire Rope**
Swift & Co., Chicago, Ill.

**LUMBER—Wire Mill, Carload shipments for lagging and car blocking**
North Anson Reel Co., No. Anson, Me.

**MACHINERY—Armoring (Cable, Wire Hose)**
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

**MACHINERY—Barbed Wire**
Glader Machine Works, Chicago, Ill.
Wean Engineering Co., Cleveland, Ohio

**MACHINERY—Bolts & Rivets**
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany

**MACHINERY—Braiding**
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Solomon, Michael, New York, N. Y.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

**MACHINERY—Bunching**
Cook Manufacturing Co., The, Paterson, N. J.
Federal Manufacturing Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

**MACHINERY—Bundling, Scrap**
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**MACHINERY—Cable, Electric**
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Capstans (See Machinery—Winding Wire)**

**MACHINERY—Chain Making**
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
Nilson, A. H. Machine Co., Bridgeport, Conn.

**MACHINERY—Closing Rope**
Watson Machine Co., Paterson, N. J.

**MACHINERY—Coiling Rod**
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Cold Heading**
Waterbury-Farrel Fdry. Mach. Co., Waterbury, Conn.

**MACHINERY—Copper Wire Drawing**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., The, Hartford, Conn.
Hale and Kullgren, Inc., Akron, Ohio
National Mach'y Exch. (Used), New York, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)**

**MACHINERY—Cutting**
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Manco Manufacturing Co., Bradley, Ill.
Mettler Machine Tool, Inc., New Haven, Conn.
Porter, H. K., Inc., Somerville, Mass.
Wean Equipment Corp., Cleveland, Ohio

**MACHINERY—Descaling Rod, Dry**
Fisher Associates, New York, N. Y.

**MACHINERY—Die Making**
Victor J. Boulin, Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.

**MACHINERY—Descaling Rod, Dry**
Firth Sterling, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Wayne Wire Die Co., Hillside, N. J.

**MACHINERY—Draw Benches**
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wartenweiler, Emilio, Milano, Italy

**MACHINERY—Edging (See MACHINery — Tandem Rolling and Edging Mills)**

**MACHINERY—Enameling**
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Oven Co., Detroit, Mich.

**MACHINERY—Extruding**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
Royle, John, & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

**MACHINERY—Fence**
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, Ohio

**MACHINERY—Filament Coil Winding**
Eisler Engineering Co., Newark, N. J.

**MACHINERY—Flat Wire**
Fenn Manufacturing Co., The, Hartford, Conn.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Manufacturing Co., Long Island City, N. Y.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio

**MACHINERY—Forming Wire**
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.

**MACHINERY—Galvanizing Wire**
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**MACHINERY—Gang Winders**
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Grinding**
Norton Co., The, Worcester, Mass.

**MACHINERY—Insulating Wire**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Solomon, Michael, New York, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R.I.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Knitting**
Fidelity Machine Co., Inc., Philadelphia, Pa.

**MACHINERY—Lacquering Electric Wire**
American Insulating Mach'y Co., Philadelphia, Pa.
Industrial Ovens, Inc., Cleveland, O.

**MACHINERY—Lock Washer**
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Looms, Wire Weaving**
Interlocking Fence Co., Morton, Ill.

**MACHINERY—Material Handling (See Material Handling Equipment)**

**MACHINERY—Measuring Wire & Cable**
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

# WHERE TO BUY, Continued

**For more complete information, consult the annual Wire and Wire Products Buyers' Guide.**

**MACHINERY—Nail and Tack**
Baird Machine Co., The, Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Pickling**
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Eng'g. Co., Youngstown, Ohio

**MACHINERY—Pin Making**
Baird Machine Co., The, Stratford, Conn.

**MACHINERY—Pointing**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale and Kullgren, Inc., Akron, Ohio
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

**MACHINERY—Poultry Wire Fencing**
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, O.

**MACHINERY—Power Transmission**
Reeves Pulley Company, Columbus, Indiana

**MACHINERY—Pre-Heater for Wire (for Extrusion of Plastics)**
Industrial Ovens, Inc., Cleveland, Ohio
National Rubber Machinery Co., Akron, Ohio

**MACHINERY—Re-Spoolers**
Boyd & Sons Manufacturing Corp., Philadelphia, Pa.
Davis Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
National Mach'y Exch. (Used), New York, N. Y.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.
Wire Insulating Machy., Inc., Manchester, Conn.

**MACHINERY—Rod Mill**
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

**MACHINERY—Rolling Mill**
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Engineering Co., Cleveland, Ohio

**MACHINERY—Rubber Insulating**
National Rubber Machinery Co., Akron, Ohio
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

**MACHINERY—Spark Testing**
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

**MACHINERY—Slitting**
Stanat Manufacturing Co., Long Island City, N. Y.

**MACHINERY—Spring Making**
Carlson Company, The, New York, N. Y.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wells, Frank L., Co., Kenosha, Wisc.

**MACHINERY—Staple**
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Straightening & Cutting**
Fenn Manufacturing Co., The, Hartford, Conn.
Kilmer, M. D., & Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Stanat Manufacturing Co., Long Island City, N. Y.
Wartenweiler, Emilio, Milano, Italy
Wells, Frank L., Co., Kenosha, Wisc.

**MACHINERY—Stranding**
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Swaging**
Fenn Manufacturing Co., The, Hartford, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

**MACHINERY—Take-Up and Pay-Out**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Hale & Kullgren, Inc., Akron, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Marshall-Richards Machine Co., Inc., Trenton, N.J.
Standard Machinery Co., Mystic, Conn.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Inc., Manchester, Conn.

**MACHINERY—Taping**
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

**MACHINERY—Testing, Physical**
Scott Testers, Inc., Providence, R. I.

**MACHINERY—Tinning Wire**
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

**MACHINERY—Tinsel Rolling Mills**
American Insulating Mach'y Co., Phila., Pa.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Trolley Wire**
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

**MACHINERY—Tube Mill, Cold Drawing**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio
Marshall-Richards Machine Company, Inc., Trenton, N. J.
Mettler Machine Tool, Inc., New Haven, Conn.

**MACHINERY—Tube Winders**
Solomon, Michael, New York, N. Y.

**MACHINERY—Twinning**
(See Mach.—Bunching)

**MACHINERY—Twisters, Wire**
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.

**MACHINERY—Used**
National Machinery Exchange, New York, N. Y.
Solomon, Michael, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

**MACHINERY—for Wire Welding (See WELDERS—Butt and Spot)**

**MACHINERY—Winding Wire**
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L., Co., Providence, R. I.
Federal Manufacturing Co., Wallingford, Conn.
New England Butt Co., Providence, R. I.
Standard Mill Supply, Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Inc., Manchester, Conn.

**MACHINERY—Wire Bending**
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio

**MACHINERY—Wire Drawing**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Fenn Manufacturing Co., The, Hartford, Conn.
Hale & Kullgren, Inc., Akron, Ohio
Herborn Maschinenfabrik, Herborn, Germany
Marshall-Richards Machine Co., Inc., Trenton, N.J.
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek. Verkstads AB Morgadshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Stanat Manufacturing Co., Long Island City, N. Y.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

**MACHINERY—Wire Forming**
Baird Machine Co., The, Stratford, Conn
Kilmer, M. D., & Co., Cleveland, Ohio
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Wire Rope**
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Wrapping with Paper**
Angier Corporation, The, Framingham, Mass.
Marshall-Richards Machine C., Inc., Trenton, N. J.
Terkelsen Machine Co., Boston, Mass.

**MATERIAL HANDLING EQUIPMENT—**
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

**MILLS—Tandem, Rolling & Edging**
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Co., Cleveland, Ohio

**NAILS—Wire**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
Wickwire Brothers, Inc, Cortland, N. Y.

**OVENS—Cable Lacquering**
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Bedford, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

**OVENS—Rod Bakers**
Carl-Mayer Corp., The, Cleveland, Ohio
Michigan Oven Co., Detroit, Mich.
Morrison Industries, Bedford, Ohio

**OVENS—Welding Rod Coating**
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Bedford, Ohio

**PAINT—Acid Proof**
Ceilcote Company, Cleveland, Ohio

**PAINT BONDING CHEMICALS—**
American Chemical Paint Co., Ambler, Pa.

**PAINTS—Heat Resisting**
American Chemical Paint Co., Ambler, Pa.
Solar Compounds Corp., Linden, N. J.

**PAPER—Creped Wrapping**
Angier Corporation, The, Framingham, Mass.
Arkell Safety Bag Co., New York, N. Y.
Terkelsen Machine Co., Boston, Mass.

**PAPER—For Coil Wrapping and Corrosion Prevention**
Angier Corporation, The, Framingham, Mass.
Arkell Safety Bag Co., New York, N. Y.
Terkelsen Machine Co., Boston, Mass.

**PATENT ATTORNEYS—**
Lancaster, Allwine & Rommel, Washington, D. C.

**PAY-OUT SYSTEMS—(See MACHINERY—Take-Up & Pay-Out)**

**PHOSPHATE COATING CHEMICALS—(See COMPOUNDS—Phosphate Coating)**

**PICKLING COMPOUNDS—**
See (Inhibitors—Pickling)

**PICKLING—Hooks, etc. Acid Resisting**
Youngstown Welding & Eng'g. Co., Youngstown, Ohio

**PICKLING TANK LININGS—**
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio

**PIPES & FITTINGS—Acid Resistant**
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio

**POTS—Lacquer**
Industrial Ovens, Inc., Cleveland, Ohio

**PRESSES—Hydraulic and Mechanical**
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio
Standard Machinery Co., Mystic, Conn.

**PULLERS AND GRIPS—For Wire**
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio

**REEL AND TENSION STANDS—**
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I
Fidelity Machine Company, Inc., Philadelphia, Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Kilmer, M. D., & Co., Cleveland, Ohio
Roll-A-Reel, Cincinnati, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Inc., Manchester, Conn.

# WHERE TO BUY, Continued

**For more complete information, consult the annual Wire and Wire Products Buyers' Guide.**

**REEL CRUTCHES—**
Roll-A-Reel, Cincinnati, Ohio
Watson Machine Co., Paterson, N. J

**REELS & SPOOLS—Aluminum Alloy**
Acrometal Products, Inc., Minneapolis, Minn.
Milton Machine Works, Inc., Milton, Pa.

**REELS & SPOOLS—Annealing and Stranding**
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio

**REELS—Metal Bound**
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
McCaskie, Inc., Wm., Westport, Mass.
North Anson Reel Co., No. Anson, Me.

**REELS—Plywood**
Carris Reels, Inc., Rutland, Vt.
McCaskie, Inc., Wm., Westport, Mass.
Nelson Company, The, Baltimore, Md.
Winchester Reel Co., Ashuelot, N. H.

**REELS & SPOOLS—Steel (All Types)**
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp Niles, Ohio

**REELS—Wire Mill**
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River, Minn.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N.J.
Hamelin, J., Lumber & Woodwork, Ltd., Lachine, P. Q., Can.
Howsam Spool Co., Aurora, Ill.
Mason Can Company, East Providence, R. I.
Milton Machine Works Inc., Milton, Pa.
McCaskie, Inc., Wm., Westport, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio
North Anson Reel Co., No. Anson, Me.
Winchester Reel Co., Ashuelot, N. H.

**REELS & SPOOLS—Wooden**
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River, Minn.
Hamelin, J., Lumber & Woodwork, Ltd., Lachine, P. Q., Can.
Nelson Company, The, Baltimore, Md.
North Anson Reel Co., No. Anson, Me.
Winchester Reel Co., Ashuelot, N. H.

**REFRACTORIES—High Temperature**
Norton Company, Worcester, Mass.

**ROD BAKERS—** (See Ovens—Rod Bakers)

**RODS—Stainless Steel**
American Steel & Wire Co., Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.

**RODS—Wire—Non-Ferrous**
American Brass Co., The, Waterbury, Conn.
Platt Bros. & Co., The, Waterbury, Conn.

**RODS—Wire, Steel**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

**ROPE—Wire**
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's John A., Sons Co., Trenton, N. J

**RUST PROOF COMPOUNDS—**
(See Compounds—Rust Preventing)

**RUST REMOVING COMPOUNDS—**
(See Compounds—Rust Preventing)

**SALTS—Heat Treating, Descaling, etc.**
Holden, A. F., Co., The, Detroit, Mich.

**SATURATION SYSTEMS—**
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.

**SOAPS—Industrial and Wire Drawing**
(See Compounds—Wire Drawing)

**SODIUM—for Descaling**
Holden, A. F., Co., The, Detroit, Mich.

**SPOOLS—(See Reels & Spools)**

**SPOOLS—Stamped Metal for Retail Wire Sales**
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

**STAMPINGS—Steel**
Acrometal Products, Inc., Minneapolis, Minn.
Art Wire and Stamping Co, Newark, N. J.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**STRIP—Steel**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

**TANKS—Compound**
Watson Machine Co., Paterson, N. J.

**TANKS—Pickling and Plating**
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Heil Process Equipment Corp., Cleveland, Ohio

**TESTERS — INSULATION (See MACHINERY—Spark Testers)**

**TESTING EQUIPMENT (See MACHINERY Testing, Physical)**

**TINNING PROCESS—**
Metal & Thermit Corp., New York, N. Y.

**TINSEL—Electric Conductor**
Montgomery Co., The, Windsor Locks, Conn.

**TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc. (See TINSEL—Electric Conductor)**

**TOOLS—Wire Cutting**
Porter, H. K., Inc., Somerville, Mass.

**TRAMRAIL SYSTEMS—**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

**TRANSMISSIONS—Variable speed (See Machy—Power Transmission)**

**TRAVERSES & DRUMS—For Reels**
(See Drums & Traverses)

**TRAVERSE MECHANISMS—**
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R.I.
Wire Insulating Machy., Inc., Manchester, Conn.

**TUBE BENDERS AND FORMERS—**
Kilmer, M. D., & Co., Cleveland, Ohio

**TURKS HEADS—**
Fenn Manufacturing Co., The, Hartford, Conn.

**VALVES & FITTINGS—Acid Resistant**
Haveg Corp., Newark, Del.

**VARNISHES—for Electric Wire**
N. E. Lacquer Co., E. Providence, R. I.
Solar Varnish Corporation, Linden, N. J.

**VULCANIZING PANS AND EQUIPMENT**
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machy., Inc., Manchester, Conn.

**WELDERS—Spot and Butt**
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

**WIRE—Aluminum**
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Malin & Co., Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, Ohio

**WIRE—Barbed**
Gerber, J., & Co., Inc., New York, N. Y.
Interlocking Fence Co., Morton, Ill.

**WIRE—Brass**
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

**WIRE—Brush**
Gerber, J., & Co., Inc., New York, N. Y.

**WIRE—Cast**
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Cold Heading**
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's John A., Sons Co., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Copper**
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Gerber, J., & Co., Inc., New York, N. Y.

**WIRE—Flat, Fine**
Anchor Wire Corp., Jamaica, L. I., N. Y.
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Gerber, J., & Co., Inc., New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

**WIRE—Forming**
Art Wire and Stamping Co, Newark, N. J.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

**WIRE—Galvanized**
Gerber, J., & Co., Inc., New York, N. Y.

**WIRE—Manufacturers**
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Gerber, J., & Co., Inc., New York, N. Y.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Newbury Co., The, Boston, Mass.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Music**
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio
Newbury Co., The, Boston, Mass.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.

**WIRE—Nickel Silver and Phosphor Bronze**
American Brass Co., The, Waterbury, Conn.
Malin & Co., Cleveland, Ohio.
Chase Brass & Copper Co., Waterbury, Conn.

**WIRE—Oil Tempered**
Pittsburgh Steel Co., Pittsburgh, Pa.

**WIRE—Spring**
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Gerber, J., & Co., Inc., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Newbury Co., The, Boston, Mass.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Stainless Steel**
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Specialty Wire Co., Inc., Worcester, Mass.
Wire Corporation, Worcester, Mass.

**WIRE—Steel—Also Coppered and Galvanized Steel**
Anchor Wire Corp., Jamaica, L. I., N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Manufacturing Co., Fostoria, Ohio
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

**WIRE—Straightening and Cutting**
Art Wire and Stamping Co., Newark, N. J.
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

**WIRE—Tungsten**
North American Philips Co., Inc., Allied Products Division, New York, N. Y.

**WIRE—Zinc**
Platt Bros. & Co., The, Waterbury, Conn.

**WRAPPING PAPER—Creped (See PAPER—Creped Wrapping)**

**YARNS & TAPES—**
Glass Fibers, Inc., Toledo, Ohio

**YARN TESTERS—**
Heineman Corp., Oscar, Chicago, Ill.
Scott Testers, Inc., Providence, R. I.

# The WATSON MACHINE COMPANY

ESTABLISHED 1845

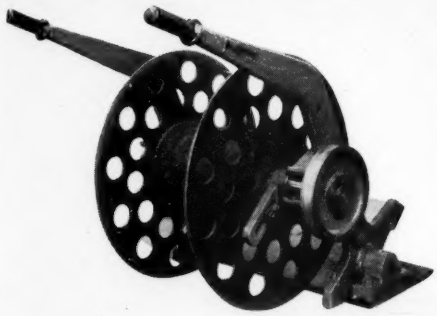
PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

# HEAVY DUTY LETOFFS

**OFFERED IN MANY DESIGNS AND SIZES, OF WHICH THE ONE MAN TYPES ILLUSTRATED HERE ARE EXAMPLES.**



**TYPE "LA"**

21"/30" UNIT SHOWN IN LOADING POSITION. DUMP TYPE WITH ADJUSTABLE SPINDLE BEARING HEIGHT. RIGID CONSTRUCTION INSURES POSITIVE BEARING ALIGNMENT. BUILT IN SIZES UP TO 36" FLANGE DIAMETER.

**"DEAD-REEL" TYPE**

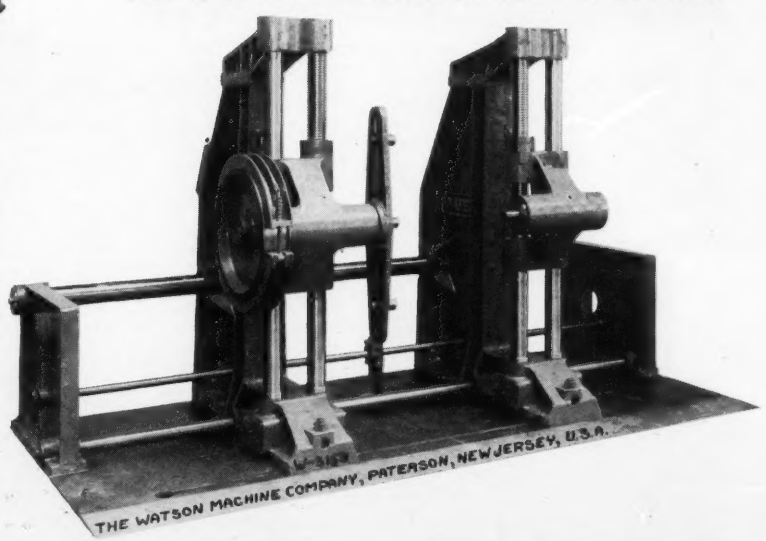
No. W-2942 SHOWS UNIT FOR 24" DIA. REELS. DESIGNED FOR CONTINUOUS CONSTANT TENSION OPERATION IN CONJUNCTION WITH CONTINUOUS VULCANIZING AND OTHER EXTRUSION EQUIPMENT. BUILT FOR REEL SIZES TO 24" FLANGE DIAMETER.

**TYPE "H"**

No. W-4411 FOR 60" DIAMETER 5 TON REELS. LIFT OPERATED BY HYDRAULIC JACK. TORQUE TUBE INSURES REEL SHAFT BEARING ALIGNMENT. WIDELY USED IN WIRE MILLS, CABLE PLANTS, WAREHOUSES AND SHIPPING ROOMS. THE VARIOUS SIZES PROVIDE FLOOR PICK-UP OF REELS FROM 16" TO 110" FLANGE DIA. AND WILL LIFT MAX. LOADS FROM 3 TO 20 TONS.

**TYPE "V"** (U.S. Patent 1,825,218)

No. W-3159 FOR 96" DIA. 10-TON REELS. "SHAFTLESS", FULLY MOTORIZED DESIGN ENABLES ONE MAN TO SAFELY LOAD THE LARGEST SIZE REELS RAPIDLY. THE VARIOUS SIZES LIFT REELS FROM 36" TO 120" FLANGE DIAMETER DIRECTLY FROM THE FLOOR. THE SMALLEST MODEL HAS 6, THE LARGEST 30 TON CAPACITY.

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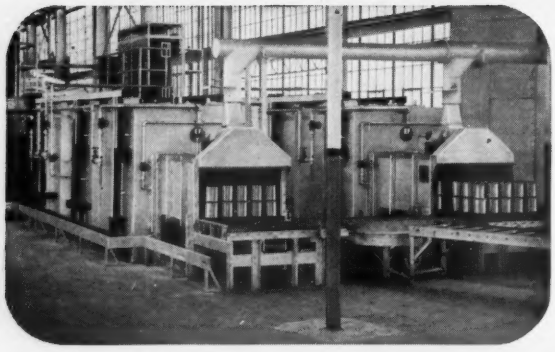
**Bulletins Covering Each Type Available**

10-52



**BRIGHT ANNEALING WIRE.** EF gas-fired and electric furnaces are built in many sizes and types for bright annealing wire on spools or reels, in coils or strands—ferrous and non-ferrous, including stainless.

**CLEAN ANNEALING** nickel-silver and other alloy wire in an EF gas fired radiant tube continuous roller hearth furnace. Handles coils up to 30" in diameter.

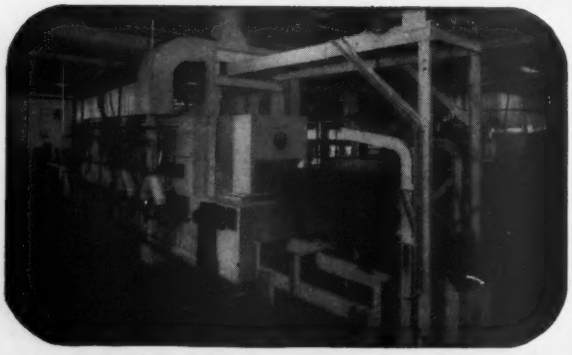
# EF builds Gas-Fired, Oil-Fired and Electric Furnaces for these and other heat treating operations

- AGING
- ANNEALING
- ALUMINIZING
- BRAZING
- CARBON RESTORATION
- CARBURIZING
- CERAMIC DECORATING
- DRAWING
- GALVANIZING
- HARDENING
- HOMOGENIZING
- MALLEABLIZING
- NORMALIZING
- NITRIDING
- SINTERING
- SOLUTION TREATING
- SPECIAL ATMOSPHERE TREATMENTS AND OTHER PROCESSES

● EF engineers specialize in designing and building production furnaces — continuous and batch types — including roller hearth, roller rail, chain belt, wire belt, slot and tube conveyor types, reciprocating, rotary, car, bell, pit and other designs; complete with special atmosphere producers, and time and labor saving material handling equipment as required.

Reflecting more than 30 years of continuous research and experience, and outstanding engineering accomplishments, EF furnaces combine high heating efficiency, accurate automatically controlled cycles, and advanced designs that minimize maintenance, assure economy of operation, high hourly output and uniformity of product.

Submit your production furnace problems to ***experienced engineers — it pays.***



**EF CHAIN BELT CONVEYOR FURNACES.** Unsurpassed for uniform, low cost scale-free hardening, carbon restoration and non-decarb heat treating small and medium size products—continuously. 11 sizes. Capacities 175 to 2000 lbs. per hour. 12 page bulletin availab'e.

## The Electric Furnace Co.

*Salem, Ohio*

**Gas-Fired, Oil-Fired and Electric Furnaces For any Process, Product or Production**